Volume 9 **Summer 2004**
Number 1

The International Journal of Construction Education and Research

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A PUBLICATION OF

THE
ASSOCIATED SCHOOLS
OF
CONSTRUCTION

ISSN 1550-3984

Journal Host
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International Journal of Construction Education and Research

Summer 2004
Volume 9, No. 1
pp. 1-62

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International Journal of Construction Education and Research
Summer 2004, Vol. 9, No. 1, pp 1-62
Copyright© 2004 by the Associated Schools of Construction
1550-3984/Editorial

Editorial
Name Change for ASC Journal

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Introduction

This is the first issue of the *International Journal of Construction Education and Research*, hosted by the Board of Directors of the Associated Schools of Construction (ASC). The ASC is an association currently comprised of more than 100 colleges and universities, each of which sponsors a construction education program. The *International Journal of Construction Education and Research* replaces the *Journal of Construction Education* which was founded in 1996 and was also hosted by the ASC=s Board of Directors. It is appropriate to note once again that Dr. Ken Williamson of Texas A&M University was the driving force behind the *Journal of Construction Education* and served as both editor and publisher for all but the final two issues.

By replacing the *Journal of Construction Education* with the new *International Journal of Construction Education and Research*, it is the hosting organization=s goal to attract not only manuscripts dealing with construction education and pedagogy, but also to publish high-quality research manuscripts addressing a wider range of topics related to the construction industry. The purpose of the *International Journal of Construction Education and Research (Journal)* is to recognize scholarly work by preserving and disseminating research manuscripts that contribute to the understanding of issues and topics associated with construction education and the construction industry. The divisions of the *Journal* will include abstracts of articles, an editorial section, blind peer-reviewed technical papers, and book reviews.

Submitting an article to the *Journal* implies the manuscript is original and is not being considered nor has been published in whole or in part within another journal. Papers that have been reviewed, presented or published within conference proceedings (such as ASC=s annual International Conferences) may be considered works-in-progress and may be submitted to the *Journal* if significant changes have been made to the research. With the exception of selected award-winning articles published in the ASC's Annual Proceedings, manuscripts not modified by this process will not be considered for publication in the Journal. Guidelines for submitting manuscripts can be found on the ASC's Website at ascweb.org.

Editorial Board Guidelines

In the spring of 2004, the ASC's Board of Directors authorized an editorial board for the *Journal*, comprised of four members. Currently serving as editor is Mark Hutchings from

Brigham Young University. Thomas Mills, from Virginia Polytechnic Institute and State University, is serving as associate editor. John Schaufelberger, from the University of Washington, and Michael Nobe, from Colorado State University, are serving as assistant editors. Following the organization of the editorial board, all four members of the board, along with Jay Christofferson, the ASC's Publications Committee Chairman, met in June at Brigham Young University in Provo, Utah to formulate future plans for the *Journal*. Following is a brief review of *Journal* policy arising out of that meeting.

- All manuscripts submitted to the *Journal* will first be reviewed by members of the editorial board for appropriate content, composition, etc.
- Manuscripts approved for peer review will then be submitted to three members of the *Journal's* Board of Reviewers who are qualified in the content area to determine whether or not the research will be accepted for publication in the *Journal*.
- Manuscripts submitted to the *Journal* should be finished products and will be accepted or rejected for publication in the *Journal* based on a majority decision of peer reviewers.
- Discussion between reviewers and authors may be appropriate at the ASC Proceedings level; however, comments to authors submitting to the *Journal* will be summarized only after a final decision is made by reviewers. Articles submitted to the Journal should not be considered Aworks-in-process.@
- For the time being, it is the intent of the Editorial Board to publish the *Journal* three times a year in electronic format.
- Beginning in 2005, the *Journal* will be indexed by Compendex, allowing for greater access and visibility.

Conclusion

As an editorial board, we realize that the policies described above may represent minor changes to some previously-held thoughts regarding *Journal* publications within the ASC. However, we are hopeful that by "raising the bar a little" these guidelines will help foster a new level of scholarship within our organization and within the industry. We also understand that there will be a transition period filled with new challenges for both authors and the editorial board. We are anxious to serve you and our industry and welcome any suggestions for improvement.

Abstracts of Research Manuscripts for the *International Journal of Construction Education and Research*

Volume 1, Number 1, Summer 2004

Teaching Methods Improvement Using Industry Focus Groups: A Case Study in Construction Financing

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Gainesville, Florida

More than 50 percent of new contractors fail within the first five years of operation. This paper attempts to address the financial characteristics distinguishing successful firms from those less fortunate in an effort to improve instructional competencies and better prepare students for careers in construction. To accomplish this objective, benchmarking data from the Construction Financial Management Association (CFMA) and the Fails Management Institute (FMI) have been complemented by University of Florida focus group research of construction industry experts to identify key financial competencies related to contractor success. A case-study project was then developed to provide delivery and reinforcement of key competencies in business start-up, project financing, and construction business operations. Next, an outcome assessment survey was administered to construction financing students to evaluate key competency levels obtained. To test the relative success of the case-study project, course evaluations for three consecutive semesters during 2002-2003, prior to project implementation, and three semesters during 2003-2004, following project implementation, were compared. Outcome assessments found that students acquired significant competencies and skill sets identified as critical by construction industry experts as well as CFMA and FMI. Course evaluations further improved nearly 30 percent when compared to evaluations prior to teaching methods improvement.

Key Words: Break-even Sales, Construction Loan Agreement, Construction Finance Education, Income Capitalization, Pro Forma, Teachings Methods Improvement, Working Capital.

“Greening” the Construction Curriculum

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Traditionally, construction education in the United States has focused primarily on the management, materials and methods and technical aspects related to the construction of a structure. Environmental concerns have been left to the architect – after all, a construction company simply performs what the specifications require. Recently, however, it has become more apparent that construction companies and personnel can have a major impact on the environment through waste management techniques, design-build contributions and through the practices and philosophy of their company. Additionally, many governmental agencies and owners are demanding that sustainability be a key component in the design and construction of structures. In this paper, the growing trend in sustainable construction will be addressed which should provide evidence to why construction graduates must become educated in this area. There are a select group of construction programs across the country already addressing the need for sustainable construction courses. These will be identified as well as other ways sustainable courses can be incorporated into the curriculum of Associated Schools of Construction (ASC) programs.

Key Words: sustainable construction, construction education, green construction, environmental construction

Management Practices of Residential Construction Companies Producing 25 or Fewer Units Annually

D. Mark Hutchings, Ph.D. and Jay P. Christofferson, Ph.D.
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The majority of home building companies in the United States produce fewer than 25 homes per year. To better understand the management practices of home builders who reportedly build 11 to 25 homes per year, a survey was mailed to 1,114 of these residential contractors who were randomly selected from the membership rolls of the National Association of Home Builders. This research report summarizes the responses received. Topics of interest addressed by the survey included construction management, accounting and planning, scheduling and estimating methods, software usage, and customer and employee relations. Most of the respondents reported excellent relationships with clients; however, relationships with employees, subcontractors, and suppliers did not seem to be as strong. It is interesting to note that some tasks, which are easily automated, such as scheduling and estimating, were usually completed by hand. The results of other findings are also discussed in detail.

Key Words: Management Practices, Residential Construction, Home Builder

Distance Education with Internet2 Audio/Video Technology

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The construction industry has changed enormously over the last 20 years and so have the tools used to manage the delivery of today's construction projects. Students, as well as current industry professionals, are finding it necessary to master these new processes, particularly those that affect communication and the handling of information, or they will be left behind. Creating new courses and continuing education classes that address this issue is a major concern. Designing courses that fit today's busy schedules and allow students to attend classes in non-traditional ways is a primary challenge for construction educators. The curricula of university programs must be adjusted to meet these changing needs. New tools are now available to help make these changes possible. Simple, fast and portable technologies can now be used to economically implement audio/visual connections between remote sites. These technologies allow distance learning to be an integral part of the solution and to meet the current needs of the industry.

Key Words: Distance learning, Internet 2, graduate education, integrated services digital network (ISDN), bandwidth, internet protocol (IP), multipoint conferencing, mixed conferences, multipoint control units (MCU), video private network (VPN).

Notes to Published Research Manuscripts
Volume 9, Number 1, Summer 2004

Two of the manuscripts published in this issue of the *International Journal of Construction Education and Research* (*Journal*) are award-winning papers from recent ASC Annual Proceedings. The manuscript entitled *"Greening" the Construction Curriculum* was honored as the best paper presented at the April 2003 ASC Proceedings held at Clemson University in Clemson, South Carolina. The other manuscript, entitled *Management Practices of Residential Construction Companies Producing 25 or Fewer Units Annually* was also honored as the best paper presented at the April 2001 ASC Proceedings held at the University of Denver in Denver, Colorado. Each paper was peer reviewed, and each was recommended for journal publication by the papers' reviewers. These manuscripts, along with a few other nominated manuscripts from each of the Annual Proceedings, then underwent a second review by members of the Proceedings' Board of Reviewers for best-paper consideration. Some 36 papers were peer-reviewed and presented during the April 2003 Proceedings, while some 33 papers were peer reviewed and presented during the April 2001 Proceedings.

In addition to the two articles mentioned above, the manuscript entitled *Distance Education with Internet2 Audio/Video Technology* was originally presented as a peer-reviewed extended abstract at the International Conference on Information Systems in Engineering (ISEC) held in Florida in June of 2003. Since that time, the paper underwent major revisions, was distributed on CD to ISEC participants, and was peer reviewed this summer for publication by this *Journal*. The fourth article, *Teaching Methods Improvement Using Industry Focus Groups: A Case Study in Construction Financing*, is an original manuscript publication.

Teaching Methods Improvement Using Industry Focus Groups: A Case Study in Construction Financing

K.R. Grosskopf, Ph.D.
University of Florida
Gainesville, Florida

More than 50 percent of new contractors fail within the first five years of operation. This paper attempts to address the financial characteristics distinguishing successful firms from those less fortunate in an effort to improve instructional competencies and better prepare students for careers in construction. To accomplish this objective, benchmarking data from the Construction Financial Management Association (CFMA) and the Fails Management Institute (FMI) have been complemented by University of Florida focus group research of construction industry experts to identify key financial competencies related to contractor success. A case-study project was then developed to provide delivery and reinforcement of key competencies in business start-up, project financing, and construction business operations. Next, an outcome assessment survey was administered to construction financing students to evaluate key competency levels obtained. To test the relative success of the case-study project, course evaluations for three consecutive semesters during 2002-2003, prior to project implementation, and three semesters during 2003-2004, following project implementation, were compared. Outcome assessments found that students acquired significant competencies and skill sets identified as critical by construction industry experts as well as CFMA and FMI. Course evaluations further improved nearly 30 percent when compared to evaluations prior to teaching methods improvement.

Key Words: Break-even Sales, Construction Loan Agreement, Construction Finance Education, Income Capitalization, Pro Forma, Teachings Methods Improvement, Working Capital.

Introduction

Accounting and other related financing control disciplines are among the most neglected control functions in contracting firms (Milliner, 1988). Many business owners have little financial background and fail to realize the importance of key financing issues either unique to or greatly magnified by construction contracting such as bonding, progress billings, retainage, working capital, cash-flow and subcontracting. In spite of overwhelming evidence that suggests financial misfeasance on the part of the contractor is responsible for the vast majority of business failures, many construction education programs have three or fewer credit hours of upper division study in this area. This is one-third or less of the concentration usually given to structures, project management and mechanical, electrical, plumbing (MEP) coursework. In fact, many schools choose to defer finance instruction to general business education programs. As a result, many graduates receive added education in entry-level estimating, scheduling and field supervision, but lack the basic financial competencies needed to lead construction organizations as future executives and business owners.

Literature Review

Financial Failures

Since 1987, the U.S. construction industry has generated some $6 trillion in sales, accounting for 4-5 percent of the U.S. gross domestic product each year (U.S. BEA, 2004). Yet, in spite of being the nation's largest industry and largest source of employment, more than 50 percent of new contractors fail within the first five years of operation, and most of these fail within the first two (Milliner, 1988). These "upstarts" usually have good field knowledge and field cost controls, but they have little knowledge of the business and financial environment. New contractors often underbid projects in an effort to break into the market, use "rule-of-thumb" markups instead of carefully calculated pricing that allows them to generate sustainable profit, or, are unaware of their "break-even" point, leaving them with insufficient volume and subsequent gross profit to cover fixed overheads (Milliner, 1988). Those that are able to formulate a competitive and profitable pricing strategy may still fall prey to the "capitalization trap", where working capital and lines of credit are insufficient to meet current liabilities and complete what otherwise would have been a profitable job (Jackson, 2002). Overcapitalization, or the under-utilization of favorable credit terms and debt leverage, strands limited cash-flow and reduces return-on-investment (Jackson, 2002). Other pitfalls include an inadequate understanding of the time-value of money, leaving the contractor to make poor investment and financing decisions, from equipment purchases to supplier credit options.

Competitive Pressures

The costly and adversarial notion of "checks and balances" between owners and contractors under the traditional design-bid-build arrangement is giving way to new delivery methods focused on accountability, value, and client retention (Good and Tyler, 2003). Construction management (CM), invited bid, and design-build delivery systems have emerged as effective alternatives for a new age of owners who are more interested in the timely delivery of an income-generating asset than a low-budget building. Realizing limits to traditional sum, scope and schedule management, many contractors are turning to turnkey services to differentiate themselves from the competition. By 2015, more than 55 percent of all contracts let will be full-service design-build, outdistancing hard-bid and CM at-risk delivery methods combined (Good and Tyler, 2003). This trend shows that owners will increasingly turn to the contractor to provide, among other turnkey services, pre-construction site selection and negotiation, income capitalization and project feasibility, design, and finance packaging. Still, many other contractors will continue to test the speculative market, where mastery of construction financing skills is essential.

Government Regulation

States that have professional licensing requirements understand that the individuals responsible for a construction project should have minimum competencies, including bonding and financial standing to protect the public from unnecessary risks. Although human health and safety remain the most obvious priorities in construction contracting, an often overlooked objective of licensure is ensuring financial responsibility. When a contractor fails, the cascading economic

impact to the owner, subcontractors, suppliers, creditors and their employees can be catastrophic. Financial malfeasance in construction often costs the taxpayer in terms of unemployment compensation and bankruptcy protection as well as reduced tax revenue from loss of productivity, reduced purchase power and damaged consumer confidence (Foster, 2000). In response, Florida codified a statewide competency examination for construction practitioners in which one-half of the 2-day exam is dedicated solely to business and financial management in construction (Florida CILB, 2004).

Methodology

Industry Advisory Focus Group

The Building Construction Executive Advisory Committee (EAC), comprised of 15-20 industry practitioners representing general contractors, construction managers and subcontractors, are invited to the University of Florida each semester to participate in a program review of estimating, structures, management, MEP, computers and technology. During one visit in August 2002, a focus group review of the undergraduate Construction Financing course (BCN 4753) was conducted to identify key financial competencies expected of construction program graduates, from entry-level positions to executive management and business ownership. Realizing "the question often determines the answer", focus group participants were encouraged to discuss topics related to construction financing openly and without the use of a scripted agenda or a written survey instrument. In addition to synergies with the existing EAC process, this survey method was selected because focus groups often suggest issues, concerns, or points of view about a topic the researcher had not considered (Ary, Chester & Razavieh, 1996).

Teaching Methods Improvement

As a result of the EAC focus group and a literature review of recommended resources from the Construction Financial Management Association (CFMA) and the Fails Management Institute (FMI), key areas for curricula emphasis and modernization were identified. A semester project was developed as an instructional medium. This consisted of a cumulative case study of key competencies learned in project financing and business start-up and operation, with the goal of developing a successful loan application package, complete with project site-selection and feasibility studies, an income capitalization budget, a construction estimate and schedule, a draw schedule, and an amortization schedule, as well as a company pro forma and business plan. The objective of this approach was to expose students to the full spectrum of construction financing, particularly those financial activities during preconstruction that are invaluable assets to the CM, design-builder, and speculative builder, or, to the general contractor who desires a better understanding of a typical project from the owner's financial perspective.

Student Outcome Assessment Survey

A knowledge assessment survey (Appendix A) was administered to University of Florida students enrolled in the Construction Financing course (n = 50) at the beginning of the Spring 2004 semester and again at the end of the semester, to assess cumulative skills obtained.

Questions were developed from key competency topics identified from the focus group's research and literature review and subsequently adopted into the Construction Financing curricula using the project case study. Respondents were asked to assign a value of 1, 2 or 3 to a total of ten (10) questions. A value of 1 meant that the student could not answer a given question; a value of 2 meant that a student could partially answer a given question; and a value of 3 meant that a student could completely answer a given question. The objective of the assessment survey was to determine the level of student knowledge entering the course and improvements, if any, in student knowledge once completing the course. In addition, lower relative outcome scores in specific areas of instruction would provide focus for continued teaching methods improvement. Surveys were anonymously administered in order to reduce bias.

Course Evaluation Survey

Course evaluations for three consecutive semesters during 2002-2003, prior to project implementation, and three semesters during 2003-2004, following project implementation (n = 248) were compared to assess the change in student satisfaction following teaching methods improvement. The standard University of Florida, Office of Academic Affairs faculty evaluation form was used. Of nineteen total questions, Questions 1 through 9 pertained to qualitative instructor attributes such as communication skills, respect for students, stimulation of interest, student encouragement, and enthusiasm for the subject. Questions 11 through19 pertained to course organization and structure, effectiveness of instructional material, time management, and representativeness of course projects and examinations to course goals and objectives. Question 10 stated "Overall, I rate this instructor as". Respondents were given values ranging from 1 through 5, from poor to excellent, and were then asked to assign a value to each of the questions. Since the same faculty member served as instructor for all semesters surveyed, and since no appreciable changes to the course other than the implementation of the project case-study occurred during this period, it can be hypothesized that changes in student perceptions would likely be the result of teaching methods improvement recommended by the EAC focus group and implemented through the project case study.

Results

Industry Advisory Focus Group

Outlined below are the summarized comments from EAC participants in the Construction Financing course review held at the University of Florida Rinker School of Building Construction on June 12, 2002.

- Explain and show examples of a construction loan agreement. Discuss lien subordination, retainage, and requirements to notify lender of changes in contract.

- Discuss the contractor's pro forma, financial ratios, and progress billings. Discuss the importance of these benchmarks in securing financing and establishing bonding capacity.

- Discuss labor burdens such as Worker's Compensation rates, modifiers, classifications, frequency and severity issues and how they impact cost to the contractor.

- Include Florida Construction Industry Licensing Board (CILB) business and financing examination topical content in the course. Consider a balance of closed and open book examinations as is typical in industry licensing.

- Suggest FMI and CFMA be used as a source of material for the class. Discuss the possibility of utilizing the Associations of Builder's and Contractor's Institute (ABCI) manual entitled, "The Contractor's Guide to Construction Management".

Teaching Methods Improvement:
A Case Study in Project Financing and Construction Business Operations

At the beginning of the semester, students were randomly placed into groups of four to five students each. Student groups were then assigned a semester project wherein they would assume the identity of a design-build firm that had selected a site for speculative development. The goal of the project was for each group to develop a successful construction loan application using information from cumulative lectures and assignments that would embody the key financial competencies identified by the EAC focus group and literature review.

Part I: Construction Project Financing (weeks 1-7)

Groups were provided design-development drawings complete with site plan, elevations, floor plans, sections and details within the first week of the semester. Groups were then instructed to develop a preliminary project plan to include the use designation of the space to be built (office, retail, medical, mixed-use, etc.) and a rationale for how the project would be successful based on economic growth trends, a low vacancy ratio, favorable absorption rates and pre-lease contracts. Students were then asked to determine land acquisition costs, using available market data from select areas of the U.S. where they planned to build. Students were also asked to provide a detailed construction estimate using Walkers or Means resources for location adjusted pricing on take-off items they planned to self-perform (CSI Divisions 3-9) and Means costs per square foot averages for the remaining work to be assigned to subcontracts. Since construction documents were approximately 75 percent permit-ready, students were given some flexibility to "build-out" the shell space to accommodate their use designation and adjust their estimates and lease rates accordingly. Estimating activities were moved forward in sequence since students had previously acquired estimating competencies in prerequisite coursework and could accomplish a major deliverable of the project early in the course.

Next, groups were instructed to develop a project budget using income capitalization. Students compared the project estimate to the project budget. Project estimates that exceeded the project budget were adjusted accordingly through various combinations of scope reduction, value-engineering, lease-rate adjustments, etc. Groups were then asked to prepare a construction schedule and a schedule of values showing planned monthly cash-flow requirements for land acquisition, design and construction. Given specific information on financing rates, term and loan-to-value (LTV) ratios, students determined how much of the project could be financed and

the amount of debt service on the construction financing. Groups then determined the equity investment required of their "company" including closing costs, points, interest carry and the net effective interest rate of the financing. With all major sources of project income and expense identified, students were then able to assemble a project feasibility analysis that would compare the project's return-on-investment to the student's minimal acceptable rate of return (MARR). MARR was defined as the weighted-average cost of capital (WACC) adjusted for risk and inflation. Specifically, students were asked to determine project net operating income (NOI), after-tax cash flow (ATCF), and after-tax equity reversion (ATER) for a 20-year holding period. Projects failing to meet the MARR or the lender-specified debt-service coverage ratio (DSCR) would be rejected.

Part II: Construction Business Organization and Operation (weeks 8-14)

Following EAC recommendations in June 2002, the Associations of Builder's and Contractor's Institute (ABCI) manual entitled "The Contractor's Guide to Construction Management" was adopted to lead students through the construction business organization and operation phase of the course. Students were provided instruction on the basics of business start-up and organization followed by the development of a balance sheet and general ledger for recognizing start-up capital, asset acquisition and financing of start-up assets. Together with general and administrative overheads, groups were asked to formulate an operating budget identifying their break-even point and profit-maximizing sales volume. Students were then given a series of assignments simulating job income, bad debts, equipment purchases, inventory, in-house payroll and subcontractor payments. Specifically, students learned percentage-of-completion accounting and methods for calculating progress billings. Students also studied Worker's Compensation, payroll taxes and many other labor burdens used to calculate job mark-ups. Students were responsible for tracking all income and expenses within accounts receivable, accounts payable, payroll, equipment and inventory ledgers as well as their group general ledger. This enabled students to see how cash flows and cash commitments changed their financial position and profitability on their income statements. Students were then asked to calculate and analyze various liquidity, profitability, capital structure, activity and capital turnover ratios from their group's pro forma to determine their bonding capacity and financial position. Specifically, students were asked to compare their capitalization, fixed asset investment, net profit margin (NPM), return on investment (ROI), leverage, and agings to actual construction firms considered "best in class" by CFMA's 2003 Annual Construction Industry Financial Survey (CFMA, 2003).

Part III: Commercial Loan Application Package (weeks 15-16)

Following business organization and operation, groups were instructed to prepare a business plan that would include fictitious narratives of the "company's" history and purpose, goals and strategies, marketing plan, organizational plan, and financial plan. Students understood that the success or failure of the loan application would depend on the financial strength of both the project and the company. Although reversed in sequence of instruction, the proposed project developed in Phase I would have to be a logical implementation of the business plan. Similarly, the goals and strategies addressing the company's financial strengths and weaknesses, as well as the company's organizational plan and pro forma developed in Phase II, should communicate the

character, capital and capacity of the company to successfully complete the project and service the debt.

The final task in the project case study was the preparation of the loan application, which consisted of an actual construction loan agreement from Compass Bank, a commercial lender. As is typical, the application consisted of three parts; a general product overview, an application and a loan covenant. Students were introduced to the content of each, although special emphasis was drawn to the loan covenant which included the terms and conditions of the agreement or loan commitment. Specifically, attention was placed on contract language that could either constitute a material breach or potentially place the contractor at unnecessary risk, such as prepayment penalty, lien subordination, securities, retainage, indemnification, material changes and contract assignment.

To encourage active participation among group members, all of the project tasks were first issued as individual student assignments. As an added incentive, students were advised at the beginning of the semester that self- and group-member evaluations (Appendix B) would be used as a basis for project grading, which, in addition to individual assignments, would constitute 40 percent of their final course grade. Specifically, the evaluation asked students to score their individual level of participation in addition to that of each group member and to provide specific justification for exceptionally high or low scores. Scores could range from 1 (lowest) through 5 (highest). Student project submissions received a "base" grade, for which a graduated scale was applied to reward or penalize students for incremental deviations in individual performance above or below the group average. Students were also encouraged to provide feedback on the project and recommendations for how the project could be improved. Evaluations were submitted electronically and kept strictly confidential. As a further incentive, 10 percent of the final project grade was based on submission of the evaluation.

Part IV: Final Examination

Students were also tested at four-week intervals to validate progressive learning. The final examination consisted of a two-hour, 100 question open-book test patterned after the Business and Financial Administrative section of the State of Florida General Contractor licensing exam. Having obtained professional licensure in August of 2002, the course instructor was familiar with the requirements and subsequent subject matter largely drawn from the ABCI Contractor's Guide to Construction Management, which again, was adopted as the course text. Results of the "licensing" examination (Table 1) show significant pass rates, although comparisons cannot be drawn to pre-teaching methods improvement since the examination itself was adopted as part of the teaching methods improvement process.

Table 1

Results of Simulated State of Florida General Contractor Licensing Exam, Business and Financial Management Section

Semester	*n*	Pass	Fail	Average Score
Fall 2002	58	56 (97%)	2 (3%)	87%
Spring 2003	53	53 (100%)	0 (0%)	92%
Fall 2003	70	64 (91%)	6 (9%)	84%

Note: Passing score ≥ 70%

Student Outcome Assessment Survey

Results of the student outcome assessment survey (Appendix A) showed, on average, students entering the course were largely unable (68.3 percent) or to a limited extent, partially able (29.6 percent), to answer questions related to financial competencies identified as key by construction industry experts and literature sources (Table 2). Students exiting the course were either completely able (51.1 percent) or partially able (40.0 percent) to answer questions related to key financial competencies (Table 3).

Table 2

Incoming Knowledge Assessment Survey, Spring 2004

Question	1	2	3	4	5	6	7	8	9	10
Mean	1.11	1.15	1.33	1.52	1.11	1.57	1.39	1.11	1.17	1.93
Mode	1	1	1	1	1	1	1	1	1	2
“1”	41	39	32	24	41	22	29	41	38	7
“2”	5	7	13	20	5	22	16	5	8	35
“3”	0	0	1	2	0	2	1	0	0	4

Average 1.34

Table 3

Outcome Knowledge Assessment Survey, Spring 2004

Question	1	2	3	4	5	6	7	8	9	10
Mean	2.56	2.36	2.67	2.67	2.31	2.33	2.33	2.28	2.11	2.61
Mode	3	3	3	3	2	2	2	3	3	3
“1”	0	4	1	2	2	2	3	6	12	0
“2”	16	15	10	8	21	20	18	14	8	14
“3”	20	17	25	26	13	14	15	16	16	22

Average 2.42

Based on an average entrance skill level of 1.34 out of 3.00 points possible, survey results showed an average increase of skills attainment of 1.08 points, or, an average exit skill level of 2.42. As a result, student knowledge of financial competencies identified as key by the EAC focus group and literature review improved 80.6 percent in relation to the student's skill level entering the course, or, 65.1 percent of the remaining 1.66 improvement points possible. The mean grade point average (GPA) for students completing the course during the Spring 2004 semester survey was 3.20.

Course Evaluation Survey

Since student outcome assessments were not begun until Spring 2004, course evaluations were the only means available to assess change, if any, in student satisfaction as a result of teaching methods improvement. Again, the same faculty member served as instructor for all semesters surveyed and no appreciable changes to the course other than the implementation of the project case-study occurred during this period.

On a standard scale of 1 (poor) to 5 (excellent), student satisfaction improved on average from 3.49 during 2000-2002 to 4.41 from 2003-2004 following EAC focus group's recommended changes implemented through the project case study. In addition to a 26.4 percent increase in mean teaching evaluation score, teaching methods improvements can be considered responsible for 0.92 (60.9 percent) of 1.51 improvement points possible (Tables 4-5).

Table 4

Pre-Implementation (Fall 2000-Fall 2001) Course/Instructor Evaluations for BCN 4753 Construction Finance

Semester	Questions 1-9	Question 10	Questions 11-19	Average
(pre-implementation)				
Fall 2000	3.42	3.39	3.63	3.48
Spring 2001	3.96	3.98	3.96	3.97
Fall 2001	2.96	2.95	3.17	3.03
			Average	3.49

Table 5

Post-Implementation (Fall 2002-Fall 2003) Course/Instructor Evaluations for BCN 4753 Construction Finance

Semester	Questions 1-9	Question 10	Questions 11-19	Average
(post-implementation)				
Fall 2002	4.27	4.35	4.21	4.28
Spring 2003	4.47	4.72	4.55	4.58
Fall 2003	4.37	4.42	4.34	4.38
			Average	4.41

Note: Instructor did not teach course in Spring 2002.

Results from a senior survey conducted independently of this research found that BCN 4753 Construction Finance was one of five program courses 2003 graduates perceived to have improved competency levels (3.79) when compared to previous graduating classes (3.33) on a scale of 1 (poor) to 5 (excellent). Results also found that Construction Finance course experienced the second largest margin of improvement and the third highest competency score of the 21 required undergraduate courses surveyed at the School.

Conclusions

The goal of this research was to address the critical financial characteristics separating successful firms from those less fortunate in an effort to improve instructional competencies and better prepare students for successful careers in construction. From industry focus group feedback and literature review data, a semester project was successfully developed as an instructional medium and as a cumulative case study of key competencies learned in project financing and business start-up and operation. Culminating in the development of a successful construction loan agreement, the objective of the project was to expose students to the full spectrum of construction financing, particularly those competencies during pre-construction that are invaluable assets to the CM, design-builder, and speculative builder, or, to the general contractor who desires a better understanding of a typical project from the owner's financial perspective. Outcome assessments found that students acquired significant competencies and skill sets identified as critical by construction industry experts as well as CFMA and FMI. Course evaluations further improved nearly 30 percent when compared to evaluations prior to teaching methods improvement.

In addition, the project served to reinforce competencies gained in prior coursework such as estimating, scheduling, computer applications, plan reading and technical writing in a comprehensive, real-world context. Students were also exposed to basic market research tasks and creative thinking. Perhaps most important, students were placed into an environment where teamwork and leadership skills could be cultivated and developed.

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Appendix A

BCN 4753 Construction Financing Outcome Assessment Survey

The purpose of this questionnaire is to help assess the effectiveness of this course. You will be asked to complete this form at the beginning and the end of the semester. Please respond with a **1**, **2** or a **3** if;

1. **You could not answer the question**
2. **You could answer the question, but not completely**
3. **You could completely answer the question**

1. ☐ Define WACC, MARR, IRR and NPV and discuss how these metrics are used to make investment decisions such as the financial feasibility of a development project, major equipment purchases, market expansion, etc.

2. ☐ Define the term "income capitalization" and explain how a commercial lender uses LTVR in establishing the loan amount for a speculative construction project.

3. ☐ Define the difference between nominal and effective interest rates and explain how lenders use origination fees, compensating balances, commitment fees and compounding periods to change the effective interest rate in a loan agreement.

4. ☐ Explain how a lender and contractor use a construction schedule and schedule of values to develop a draw schedule, and how interest reserve and interest carry are determined, as part of the loan agreement.

5. ☐ Define the term "pro forma" and explain how financial statements are used to in the course of construction business operations such as preparation of bids, break-even sales volume, budget forecasts, profit projections, bonding capacity and line of credit.

6. ☐ Explain the difference between cash (completion) and accrual (progress billings) methods of accounting and which provides a more accurate picture of the contractor's financial position at any point in time.

7. ☐ Explain how a contractor can show a profit but be working capital constrained. List five (5) methods at the contractor's disposal to improve cash flow.

8. ☐ Define the term "relevant range" and explain how this concept relates to fixed overheads, sales volume and net profit.

9. ☐ Define the term "fully burdened labor" and explain how this concept relates to the estimating and bidding process.

10. ☐ Define the term "depreciation" and how it relates to income recognition. List three (3) methods of depreciation and explain the IRS limitations of each.

Appendix B

BCN 4753 Construction Financing Project Peer Evaluation

Self Evaluation:

1. Please rate your level of participation and contribution to your group project. Choose from 1 to 5 using the following criteria:

1	**3**	**5**
Minimal contribution. Partial completion of assigned tasks. Work product late and of poor quality.	Average contribution. Near full completion of assigned tasks. Work product timely and of good quality.	Provided group leadership while setting group standard for work productivity and quality.

Your name: _____.

Your group number: _____.

Your self-evaluation rating:_____.

Group Evaluation:

2. Please rate the level of participation and contribution for each group member. Choose from 1 to 5 using the criteria above:

Group member name:_____ Rating:_____

Group member name:_____ Rating:_____

Group member name:_____ Rating:_____

Group member name:_____ Rating:_____

Comments:

“Greening” the Construction Curriculum

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Traditionally, construction education in the United States has focused primarily on the management, materials and methods and technical aspects related to the construction of a structure. Environmental concerns have been left to the architect – after all, a construction company simply performs what the specifications require. Recently, however, it has become more apparent that construction companies and personnel can have a major impact on the environment through waste management techniques, design-build contributions and through the practices and philosophy of their company. Additionally, many governmental agencies and owners are demanding that sustainability be a key component in the design and construction of structures. In this paper, the growing trend in sustainable construction will be addressed which should provide evidence to why construction graduates must become educated in this area. There are a select group of construction programs across the country already addressing the need for sustainable construction courses. These will be identified as well as other ways sustainable courses can be incorporated into the curriculum of Associated Schools of Construction (ASC) programs.

Key Words: sustainable construction, construction education, green construction, environmental construction

Defining Sustainable Construction

Many definitions exist regarding sustainability and green or environmental design. However, the most accepted and widely used definition today was that developed by the United Nations Commission on Environment and Development (the Bruntland Commission). This definition contends that sustainable development “meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission, 1987). From this, a separate definition can be derived for sustainable construction as “those materials and methods used to construct and maintain a structure that meets the needs of the present without compromising the ability of future generations to meet their own needs”. There are many ways contractors can build in a sustainable manner. These include reuse and recycling of existing structures and materials, jobsite waste management, choosing and educating suppliers for environmental purposes and building commissioning and monitoring, among others.

Benefits of Sustainable Construction

While only 4% of the total space built in the United States in 2001 could be considered green, this number is growing exponentially as many builders and owners are realizing green building will not only help their corporate image, but their profits as well (Freemantle, 2002). Incorporating green features into a structure can help set builders apart, and marketing incentives typically tied to green programs can increase traffic to projects and awareness of a company (Foerste, 2002). Also, in many areas of the country, substantial savings can be realized from the

reuse and recycling of construction components which can help a contractor's bottom line and project opportunities (ECCO, 1997). Additionally, owners are getting into the act as they are discovering that green structures not only reduce operating costs, but attract young, highly intelligent workers that prefer companies that demonstrate a commitment to the environment (Flanders, 2001). Companies that sell natural products such as Perrier often see green buildings as "marketable commodities consistent with its product". Reports have also shown that employee productivity can increase drastically when a building is designed and constructed in a sustainable manner (Freemantle, 2002). Finally, state and local governments are increasingly establishing requirements for their own public-sector buildings as they realize the financial and social benefits of green building (State and Local, 2002). These positives help explain why sustainable construction is becoming so popular.

The Growth of Sustainable Construction

One of the most obvious indicators of the growth of sustainable practices in the commercial sector is the tremendous expansion of the United States Green Building Council (USGBC) and its Leadership in Energy and Environmental Design (LEED) program in recent years. LEED is a voluntary standard for sustainable buildings in which certification occurs upon meeting specified criteria to achieve one of four rating designations. Today, more than 800 structures are registered to receive LEED accreditation (Malli, 2003) with 93 already LEED certified. Additionally, the USGBC now has almost 3,600 members (USGBC[3], 2003), up from approximately 250 just four years ago (Freemantle, 2002). Figure 1 below illustrates this growth, with particularly high acceleration among constructor memberships which have almost tripled, both in 2002 and 2003.

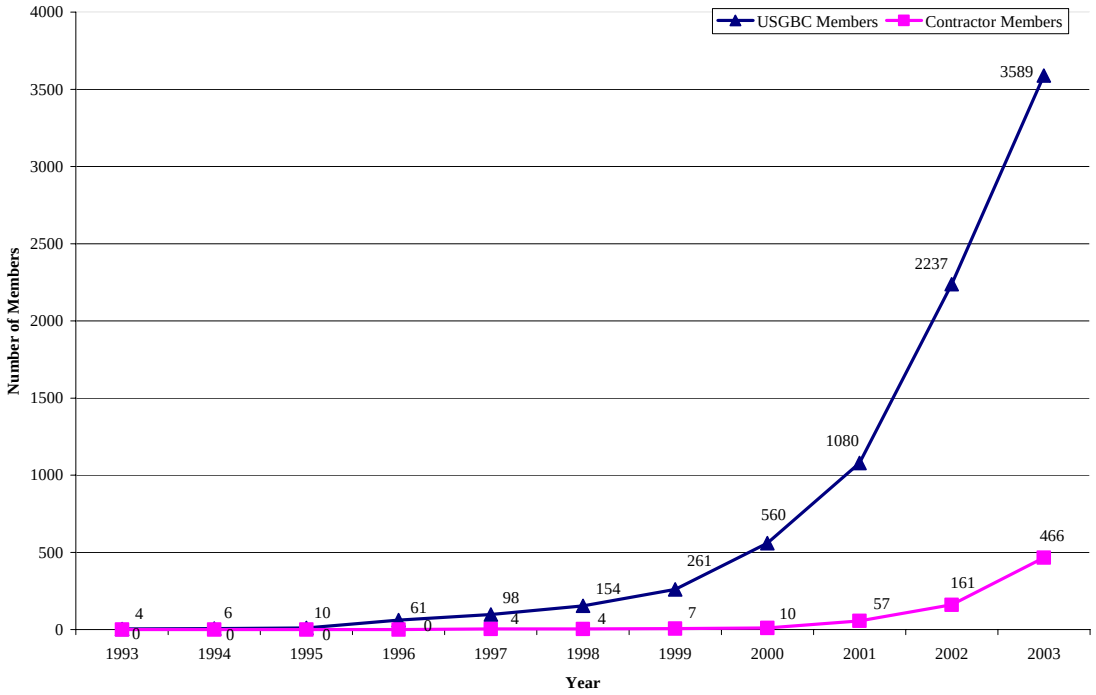

Figure 1: USGBC total membership and construction membership.

Besides creating and monitoring the LEED certification process, the USGBC is also responsible for coordinating the Green Building International Conference and Expo. This year's annual conference attracted over 5,200 professionals (USGBC, n.d.), up from 4,000 registrants in the conference's first year. Included among these were several major construction companies including Austin Commercial, Turner Construction and Centex Construction, just to name a few. Also included were a host of private owners and municipalities dedicated to implementing more sustainable construction approaches.

In addition to the explosion of sustainable construction in the commercial market, residential initiatives in green construction are growing as well. In fact, the first green rating system in the country was developed as the Austin Green Builder Program in 1990, which at the time was purely residential. Today, approximately 30 green building programs are functioning throughout the country, with more in the development stages (NAHB, 2002, Energy Efficiency, 2003). While the functions of these programs vary, the primary goals of all are to increase education and thus acceptance of green building as a necessary technique for future growth. The number of homes registered within these programs varies substantially, with over 18,000 registered in the Built Green Colorado program (BuiltGreen, 2003) to very few homes registered in the newer programs (NAHB, 2002).

To keep up with and ahead of the growing trend in sustainable construction, trade organizations are developing materials and committees that deal specifically with sustainable construction. The Associated General Contractors (AGC) has made several steps toward educating its members, including the publication of educational materials, the inclusion of environmental news and updates in its newsletter and recognizing members for participating in green construction efforts (Gaskins, 2002). The National Association of Home Builders (NAHB) has made considerable efforts towards green education, including conducting green building research, publishing sustainable construction materials and holding a national green building conference which will be in its fifth year this April (NAHB, 2002).

Government initiatives and regulations have also been established across the country that either promote voluntary participation or mandate participation in green building efforts. For instance, the City of Dublin, California requires all construction projects over $100,000 to submit waste management plans for reducing landfill waste by 50% (California, 2002). Incentives are currently being used in most areas in lieu of regulations. Providing technical support, speedier approvals and marketing are techniques being used around the country (State and local, 2002). Tax credits are another method municipalities use to encourage environmental construction; and some city programs, such as the Seattle City Light's program, actually reimburse contractors for incorporating energy efficient products and designs in their structures (State and local, 2002).

The U.S. Army Corps of Engineers has become actively involved in promoting green construction on all projects. The sustainable project rating tool (SPiRiT) was developed to measure sustainability in military designs. It is very similar to the LEED rating system, but adds additional rating areas that apply to military facilities. It has been mandated that all Army constructions use SPiRiT to evaluate their sustainability, and currently the Army has a goal of achieving Bronze level on all new projects.

Construction research is also becoming involved in sustainable ideas as the 2003, 11th International Conference held by the Center for Construction and Environment at the University of Florida's focus was deconstruction and material reuse. The conference organizers' objectives were to address the issues required to make deconstruction and materials reuse a viable option for the construction industry. Information was backed by a four-year study of deconstruction by The International Council for Research and Innovation in Building Construction (M.E. Rinker, 2002).

Finally, many construction firms are implementing environmental initiatives. Skanska construction company, one of the three largest construction companies in the U.S., is focused on minimizing the environmental impact of construction and sees their techniques as an asset that sets the company apart from competitors (Skanska, n.d.). Affiliated Construction Services, Inc. now advertises their employment of a LEED Certified Professional on staff and the CEO of Turner Construction was quoted as saying, "Turner is enthusiastically seeking new green building opportunities, expanding our range of services and investing in our staff to ensure the success of our green building projects" (Leppert, n.d.). With two of the top five ENR contractors and others leading the way to more sustainable construction, it is certain that other companies must follow.

Sustainable Construction Education

Sustainable construction is "not a fad anymore; it's a megatrend" (Freemantle, 2002). With this explosion comes an increasing need for construction managers with knowledge in the various aspects of green building. To produce construction graduates who meet this need it is necessary to retool programs so that they incorporate green philosophies and techniques. Construction students must be educated with a "whole building" mentality so they can realize the interrelatedness of building components in lieu of the current method of teaching compartmentalized information applicable only to constructors. Green education can easily be integrated into programs either by incorporating green ideas into existing courses such as materials and methods or mechanical/electrical courses or by creating new courses that focus primarily on sustainable ideas (Mead, 2001).

Incorporating Sustainable Issues into Construction Education Programs

The growth and importance of sustainable construction is undeniable. Thus, to keep up with the times, construction education programs must incorporate courses in sustainability so that their students will be able to participate and be valued in the workplace. The American Council for Construction Education (ACCE), the accrediting agency for many of the higher-education construction programs around the country, now includes environmental coursework within its approved curriculum. For instance, courses in environmental sciences may be used for math and science credit hours. Additionally, courses which cover environmental issues may be used for construction science coursework. ACCE guidelines even mandate that environmental issues be covered as parameters affecting project planning (ACCE, 2002).

In order to assess efforts being made across the country in environmental construction education, a survey was issued to ASC member contacts to identify examples of how sustainable or green issues were being incorporated into the curriculum. Information on the existence of sustainable courses or the incorporation of sustainable issues into existing courses was sought specifically.

The survey found several schools currently address sustainable issues in a variety of classes. Two good examples are Colorado State University and University of Florida. Colorado State currently has three environmental courses: Sustainable Design and Construction, Appropriate Technology for Sustainable Living and Sustainable Technology in Built Environments. The Sustainable Design and Construction course is unique in that it is an interdisciplinary course in which students travel to the Virgin Islands and live and learn in an eco-camp for two weeks. The graduate course in Sustainable Technology in Built Environments covers all aspects of sustainability in construction, design and development. The Department of Manufacturing Technology and Construction Management also houses the Institute for the Built Environment which helps foster sustainable research projects among students (Colorado, 2002). Finally, two of the three graduate emphasis options, Sustainable Building and Historic Preservation, involve environmental issues (Colorado, 2004).

The University of Florida has three sustainable courses: International Sustainable Development, Principles of Sustainability, and Construction Ecology and Metabolism. The undergraduate International Sustainable Development course covers environmental trends around the globe currently being utilized to reduce the environmental impacts of construction and development. The two graduate courses investigate how the construction industry must change with the environmental movement and how environmental and industrial ecology relate and apply to the built environment. Master of Building Construction and Master of Science in Building Construction graduate students may also earn a Sustainable Construction Concentration designation which entails that students take the two sustainable construction courses mentioned above in addition to six hours of non-construction courses from a list of approved environmental electives (University of Florida, 2002).

Texas A&M University has recently added two environmentally-related courses to the graduate curriculum. These include Earth Construction and Sustainable Construction. The first course investigates various methods of earth construction and includes hands-on experience in several earth methods. Texas has a history of earth building particularly in the western part of the state and many of the graduate students of the Construction Management Program are international students from areas where earth is still considered a contemporary building material. The Sustainable Construction course covers all components of a sustainable construction project, investigates sustainable programs around the country and even included a trip to the International Green Building Conference. Additionally, a Sustainable Development emphasis is now offered through the College of Architecture.

Stanford University has a variety of courses involved in sustainable practices as well. Two undergraduate energy-related courses include Energy Efficient Buildings and Electric Power: Renewables and Efficiency. Photovoltaics, wind energy and passive systems are investigated in these courses, among other topics. Many other green courses are available through the School of Engineering which houses the Construction Engineering and Management program such as

Environmental Science and Technology, Green Architecture and Air Quality Management; however, these are not required by Construction students (Civil, 2002).

Other schools are adding or currently include sustainable construction courses as well. Temple University includes a graduate course called Sustainable Development and Industrial Ecology. The University of Nebraska at Kearney has an undergraduate course in Alternative Energy. Prior investigation has also identified environmental construction courses at other ASC member universities including an Environmental Construction course at the University of Louisiana at Monroe and a Lab for Sustainable Design and Construction at the Georgia Institute of Technology. Environmental topics were also mentioned as a portion of other courses at Virginia Polytechnic Institute and State University, Minnesota State University Moorhead, Alfred State College and Old Dominion University (Tinker & Burt, 2002).

Individual courses in sustainable construction are not the only technique to include environmental education into the construction curriculum. Sustainable ideas can be incorporated into existing classes throughout the program. Materials and methods courses can be supplemented with environmental products and techniques included in each respective CSI category. Alternate energy systems, efficient HVAC and water conservation techniques can be included in mechanical and electrical courses. Efficient material usage can be taught in estimating courses and environmental jobsite techniques can be covered in construction administration or project engineering courses.

Discussion

It is clear that the construction industry is starting to turn green. This process will require many companies to modify their work and practices, particularly in the area of construction waste management. Construction educators can help this process by providing a curriculum that addresses sustainable or green issues.

There is both a moral and financial responsibility to educate future constructors in sustainable issues. Leading construction companies are becoming involved in green construction. They will be looking for graduates who are suitably prepared in sustainable ideas and practices. Additionally, if the membership in the USGBC continues to grow at the current rate, it is almost certain that all construction graduates will at some time work on a green project. For the employment futures of these students and the success of programs in placing students, it is imperative that they have the skills necessary to compete in this new job market.

Based on survey responses and prior assessment of environmentally-related construction courses among ASC member universities, it is clear that very few universities are currently educating their students on sustainable construction issues. There are a few universities that have taken a lead in this area that are offering either individual courses or incorporating green ideas into the curriculum. This is allowed and even promoted within the ACCE guidelines.

With the increased demand for knowledge on environmental issues from owners and municipalities, the growth of design/build and the increasing need for environmental initiatives

by all businesses, it is imperative that construction programs start including environmentally-related courses or adding environmental topics to existing courses in their curriculums. Only then will graduates be prepared for the future and able to make a positive difference to the environment.

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Management Practices of Residential Construction Companies Producing 25 or Fewer Units Annually

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The majority of home building companies in the United States produce fewer than 25 homes per year. To better understand the management practices of home builders who reportedly build 11 to 25 homes per year, a survey was mailed to 1,114 of these residential contractors who were randomly selected from the membership rolls of the National Association of Home Builders. This research report summarizes the responses received. Topics of interest addressed by the survey included construction management, accounting and planning, scheduling and estimating methods, software usage, and customer and employee relations. Most of the respondents reported excellent relationships with clients; however, relationships with employees, subcontractors, and suppliers did not seem to be as strong. It is interesting to note that some tasks, which are easily automated, such as scheduling and estimating, were usually completed by hand. The results of other findings are also discussed in detail.

Key Words: Management Practices, Residential Construction, Home Builder

Introduction

In 1999, annual revenues of $208 billion generated from the building of single-family housing units within the United States dwarfed all other categories of construction (King, 1999). Of the residential builders performing this huge amount of work, companies producing twenty-five or fewer homes per year currently make up the majority of home building firms in the United States (Carliner, 1999).

It has been proposed by some researchers that the implementation of specific management practices is one of the most influential factors contributing to the ongoing success of construction firms (Adrian, 1976; Lussier, 1995; Strischek, 1998). In fact, small business failures, including those of home building companies, typically seem to be characterized by a lack of management skill and experience (Flahvin, 1985; Gaskill, Van Auken, & Manning, 1993). By identifying important management practices used by small-volume home builders, a measuring stick can be provided against which owners can compare their own business practices.

The Statement of the Problem

The purpose of this research is to identify the current level of use of pre-selected management practices in small-volume home building companies that reportedly produce eleven to twenty-five new homes per year.

Limitations

This study was limited to companies that were builder members of the National Association of Home Builders and reportedly built eleven to twenty-five new homes per year. Only data from companies whose main source of revenue was from the construction and sale of new homes was used.

Delimitations

This research is intended to identify and describe the level of use of some of the most important management practices implemented by small-volume home building companies in the United States; however, it is not intended to describe all possible factors which might influence those companies. For example, such things as leadership abilities of owners/managers, inherited wealth of owners, and their reputation in their community are but a few of the possible confounding factors that might contribute to the success or failure of a small-volume home building company. These are a few examples of possible topics for further research.

The Data and the Treatment of the Data

In an effort to describe current management practices of small-volume home builders, a nationwide survey was conducted by mailing written questionnaires to owners and managers of 1,114 companies. These companies were randomly selected from the population of builder members of the National Association of Home Builders who reported building eleven to twenty-five homes per year.

According to the information available at the time of the mailing, there were approximately 62,450 builder members of the NAHB nationwide, including home builders, remodelers, and developers. Of these, some 40,984 firms reported that they started at least one new home during the year. Companies reporting between 11 and 25 new residential starts for the year numbered 20,979 and represented more than half of the firms which reported housing starts. The remainder of the population was divided into four other segments. There were 6,563 companies starting between 1 and 10 units per year, 7,079 companies starting between 26 and 100 units per year, 4,426 companies starting between 101 and 500 units per year, and 1,937 companies starting more than 500 units per year (Evans, 2000).

The questionnaire was designed to identify the use of management practices and was developed by utilizing a two-fold approach. First, literature related to management practices employed by home builders was reviewed; and second, owners of home building companies, accountants, and university faculty whose areas of research addressed issues in construction company management were interviewed. From these sources, an initial list of more than 100 management practices was developed. This list was then reviewed by the Business Management and Information Technology Committee of the National Association of Home Builders, whose members included home builders, accountants and businessmen with extensive experience in owning and operating residential construction companies. During several work sessions of this

group, which included the authors, the list of topics was narrowed to those considered to be the most important. A final questionnaire was then created and tested for understanding and readability.

Research Design

The population of interest in this study was quite large, consisting of almost 21,000 companies nationwide. In order to obtain results that would provide a 95 percent level of confidence, with a plus or minus 5 percent margin of error, it was necessary to obtain data from approximately 400 firms (Hill, Roth & Arkin, 1962; Weisberg & Bowen, 1977). In a similar study, fewer than 2 percent of the surveys were returned to the researchers by the post office because of incorrect addresses (Hutchings & Christofferson, 2000). By predicting a 40 percent response rate of those sampled, and by applying this 98 percent contact rate, a minimum sample size of 1,020 companies was required. The formula used was Sample Size = 400 / (.40 x .98).

In order to collect data describing the current management practices of those residential companies to be surveyed, a written questionnaire was sent to the owners of each company that was selected to participate in the study. There were at least two major reasons for utilizing questionnaires in this research. First, it would be financially impractical to conduct personal or telephone interviews with so many owners; and second, in order to answer questions regarding some of the management practices addressed, respondents might find it necessary to access records not immediately available during a personal interview (Leedy, 1993).

Description of Companies Responding to the Survey

A number of interesting factors surfaced from the information provided by the companies that responded to the survey. For example, it was discovered that the average company had been in business for 16.22 years. A possible explanation may be that companies that joined the NAHB had been in business for some time before recognizing the benefits of such an organization, whereas “younger” companies may not have perceived enough benefits to warrant the cost of membership. In addition, 42 percent were doing business as S-corporations, 26.35 percent were sole proprietorships, 19.53 percent were C-corporations, 8.71 percent were limited liability companies, and 3.29 percent were general partnerships.

Seventy-five percent of the homes that were marketed were sold for more than $150,000 each. More than half (52.5 percent) of the new homes built were sold for more than $200,000, while 29 percent were sold for more than $300,000. More than one-tenth of all homes produced by these companies, some 11 percent, were priced at over $500,000 each. Pre-sold homes represented 50.92 percent of all sales, while 28.16 percent were built on speculation. The balance of operational revenues consisted of residential remodel work (12.95 percent), commercial jobs (6.34 percent), and other income, including finished lot sales (1.63 percent).

Analysis of the Data

The total number of responses (n) for all questions ranged from 408 to 427, with the great majority of questions receiving response rates of 426. Questions eliciting the smallest response rates had to do with accounting and reporting of finances.

Builders were asked what types of computer software they regularly used. Figure 1 indicates the responses. Word processing and general accounting were the two most frequently used software applications. Purchase-order systems and dedicated scheduling and estimating programs were the least frequently used.

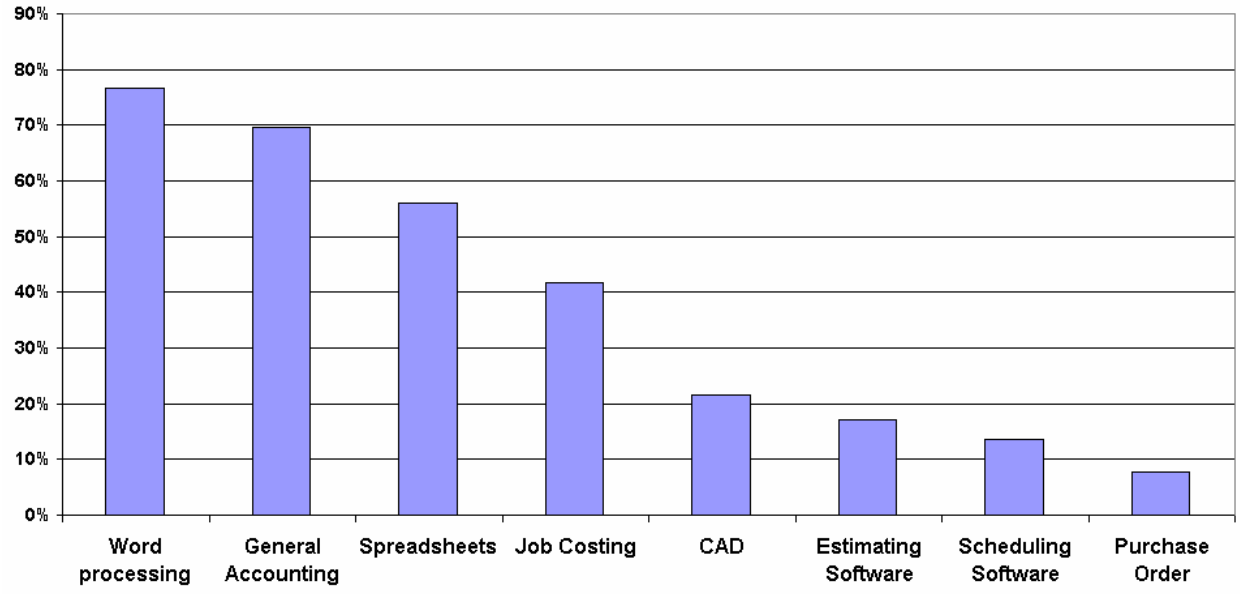

Figure 1. Software applications regularly used.

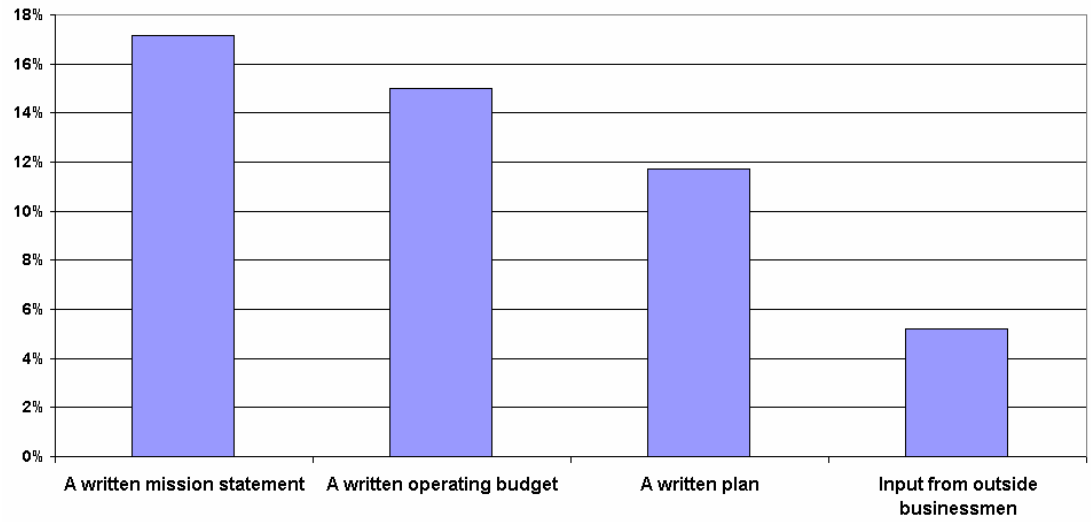

Figure 2. Business planning.

Just over 17 percent of the respondents had written mission statements, only about 15 percent had written operating budgets, and even fewer (11.74 percent) had written business plans. Very few of these businesses (5.19 percent) hired outside consultants on a regular basis (Figure 2).

When asked about scheduling construction activities, a majority of the builders indicated that they used "daily to-do lists" (72.77 percent) as their primary method, while relatively few builders used CPM programs (18.08 percent) or simple bar charts (11.27 percent). Nearly one-fourth reported that they did not have any formal scheduling procedures of any kind (23.71 percent). Also of interest was the fact that 29.4 percent of the respondents updated schedules only monthly, while 42.6 percent updated weekly, and 27.9 percent updated their schedules daily (Figure 3).

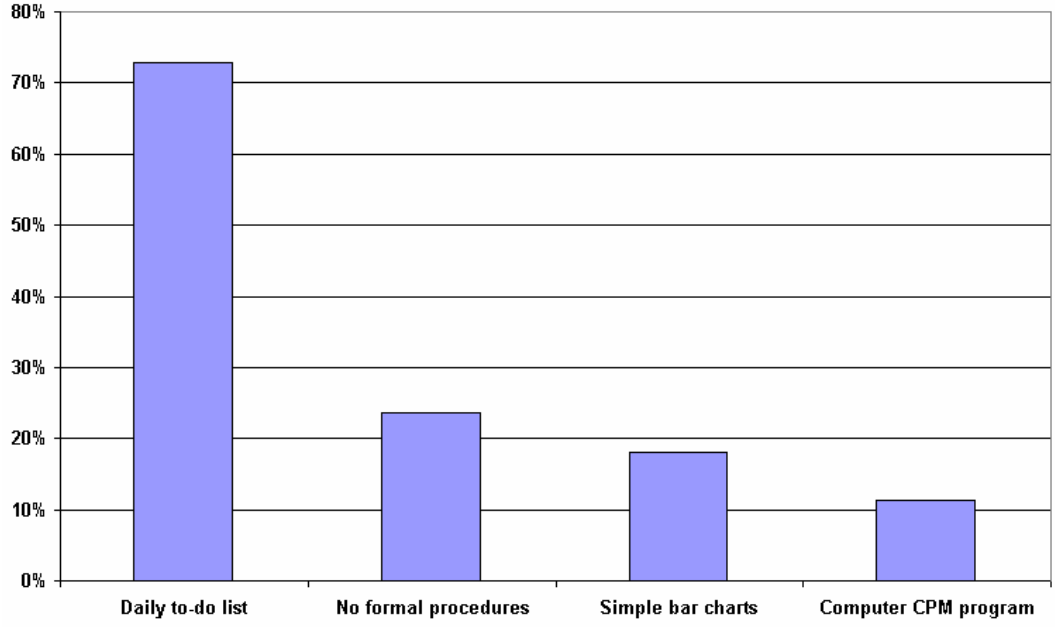

Figure 3. Scheduling techniques.

In estimating job costs, companies reported that about one-third of their estimating was completed using detailed quantity take-off methods, while just under 30 percent of their estimating was done using subcontractor or supplier bids. It is interesting to note that seven percent of those surveyed reported that not only did they perform all of their estimating by using detailed quantity take-offs methods, but in addition, they also required subcontractor and supplier bids for each division of work. Seventeen percent of the estimating was done using square-foot unit-pricing methods, and it was reported that best guess plug-in amounts were used about nine percent of the time. The respondents reported that eight percent of their estimating was handled as allowances. It was noted that many who used detailed quantity take-offs methods or subcontractor and supplier bids to put together estimates treated these as allowances (Figure 4).

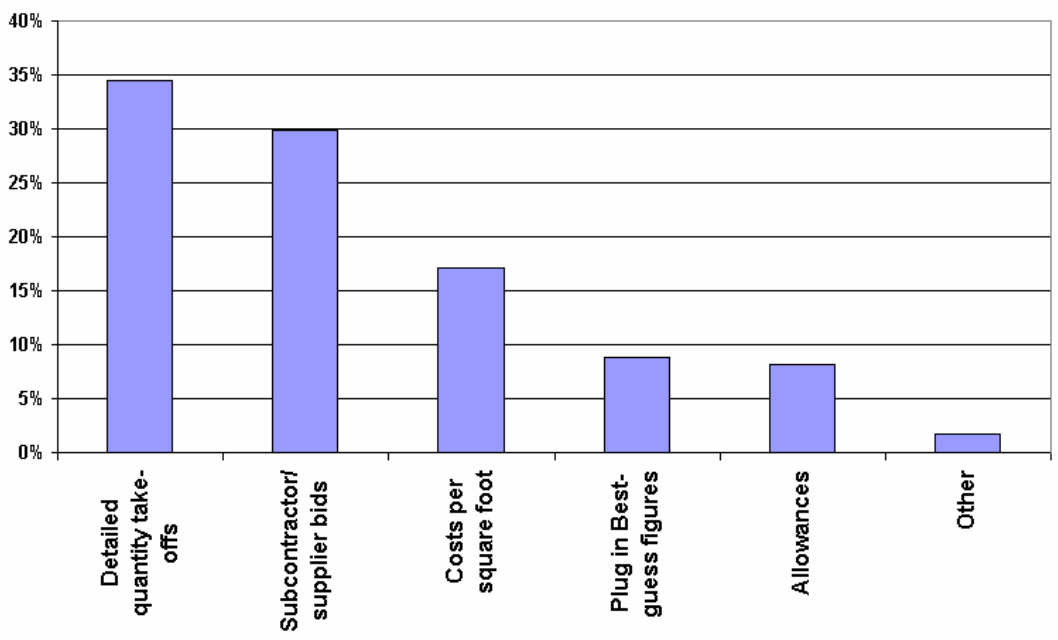

Figure 4. Breakdown of estimating methods.

Good customer relations seemed to be very important to most builders (Figure 5). More than 75 percent of the respondents used written specifications and held formal pre-construction meetings. For most, it was important to meet scheduled closing dates, to implement formal home demonstrations or walkthroughs and to use detailed contracts.

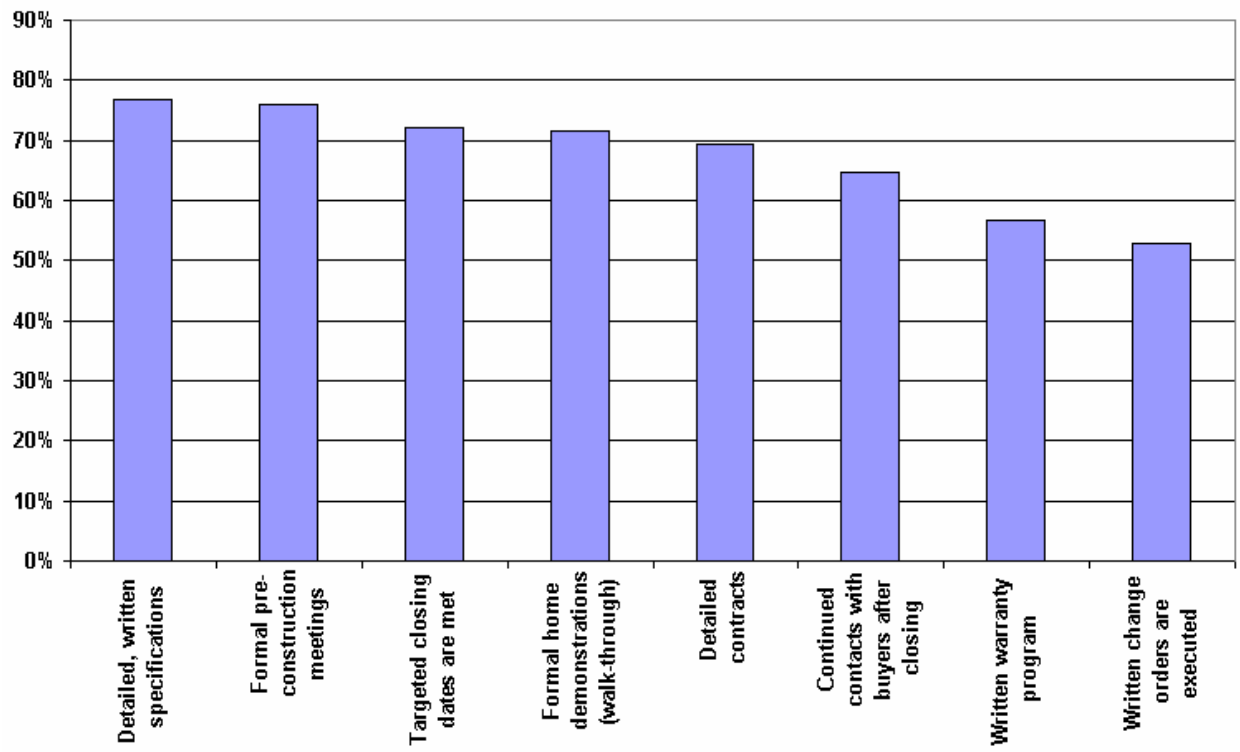

Figure 5. Customer relations.

Nearly 82 percent of the respondents reported spending less than one percent of operational revenues on advertising (Figure 6). More than half of the new home sales were the result of past customer referrals or word of mouth advertising. Real estate brokers accounted for 23% of home sales, job signage produced 10 percent of the sales made, and model homes, Parades of Homes or local home shows, architect referrals and websites jointly accounted for approximately 13 percent of the sales.

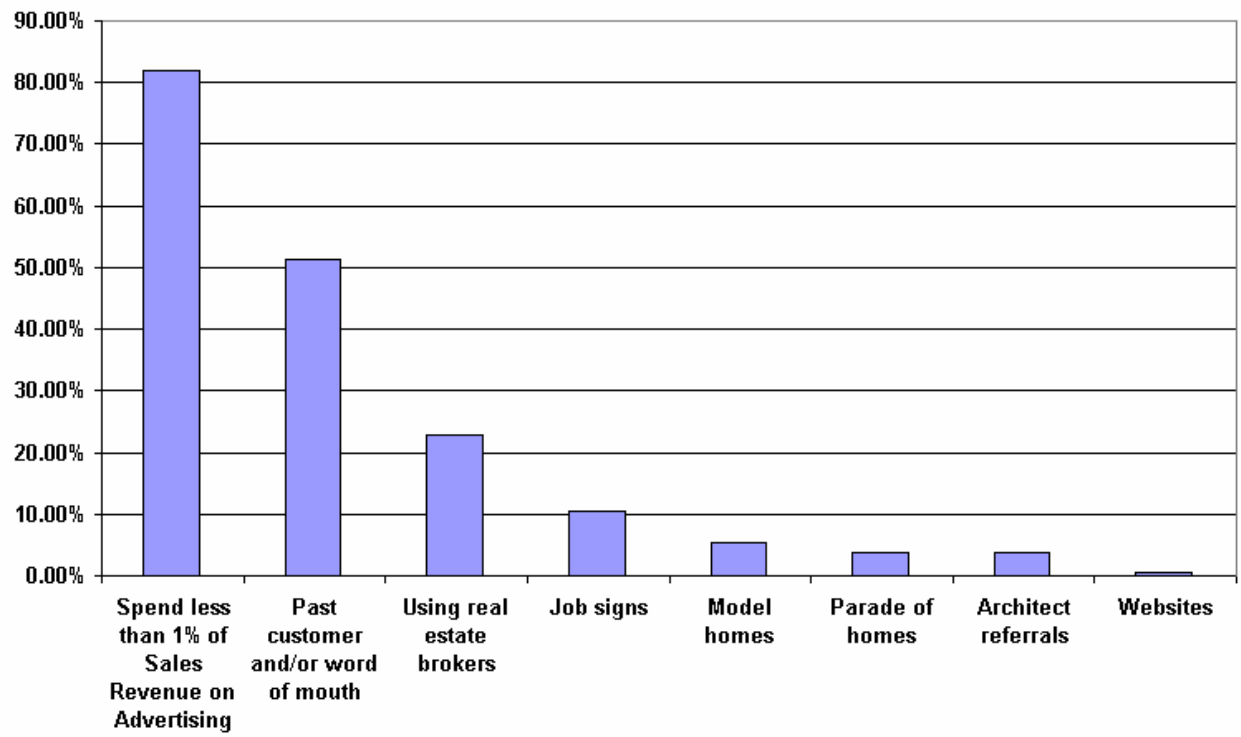

Figure 6. Advertising and Job Sources.

Builders reported not spending nearly as much time developing subcontractor and supplier relationships as they did managing customer relationships (Figure 7). Less than half (44.1 percent) used detailed subcontractor or supplier specifications, 36.67 percent used quality control checklists, and nearly 29 percent had regular construction meetings with subcontractors.

When asked about their companies' profitability compared to other home building companies of a similar size, only 40 percent thought they were more profitable (Figure 8). Over 60 percent reported that income statements, balance sheets, and job-cost variance reports were reviewed quarterly. With the exception of job-cost variance reports (56.26 percent), about 40 percent reported that they reviewed these reports monthly.

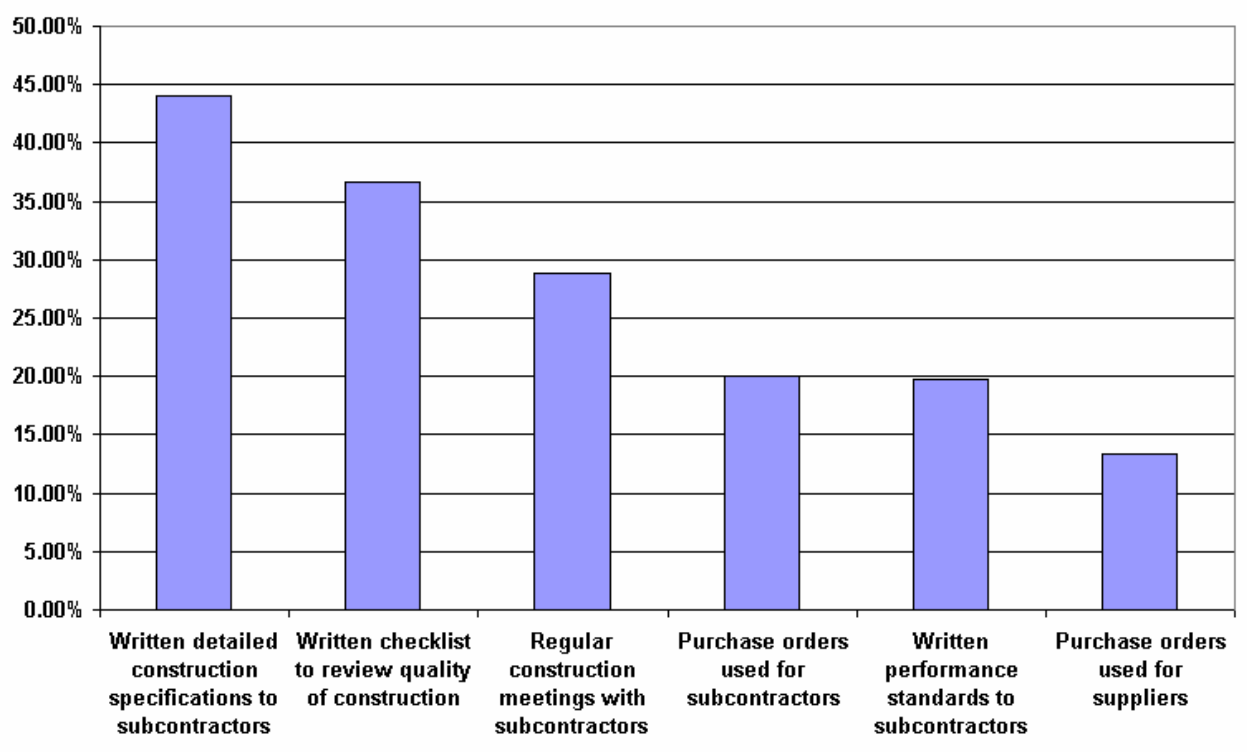

Figure 7. Subcontractor and supplier relations.

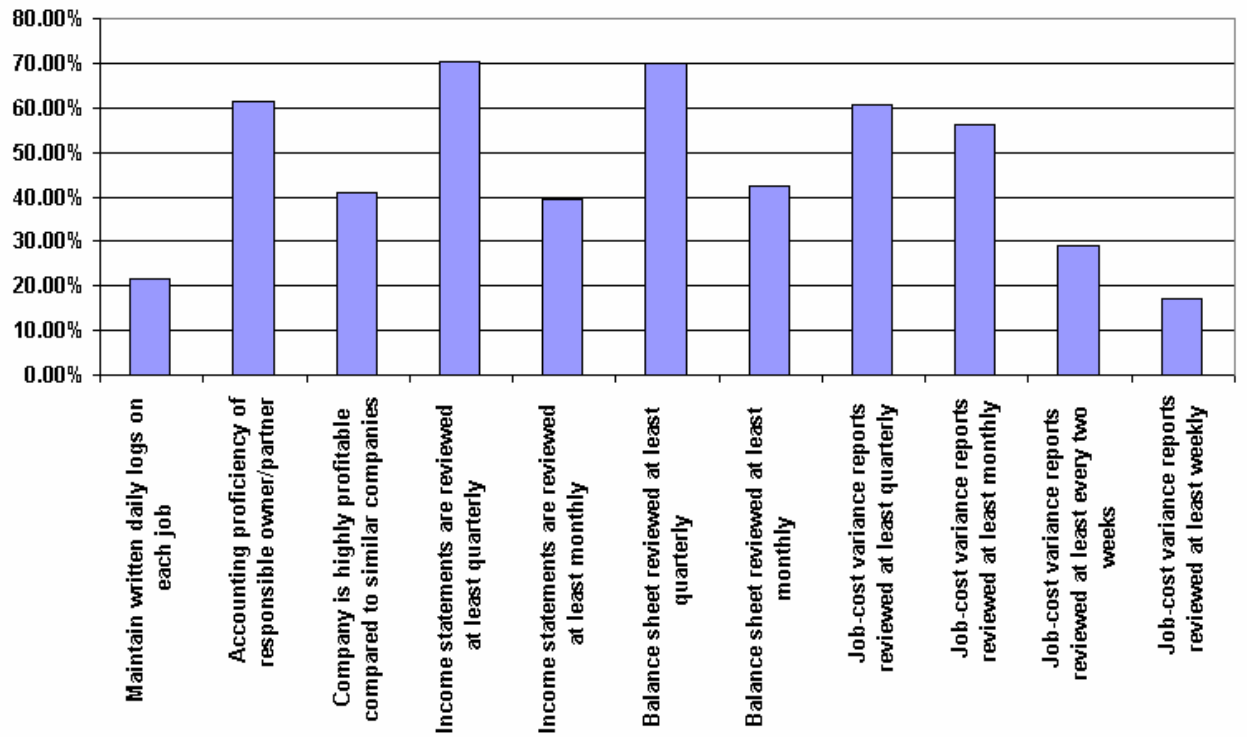

Figure 8. Accounting and Record Keeping.

Although nearly 40 percent of the companies provided in-house training of employees, less than 30 percent utilized written guidelines and policies (Figure 9). About 20 percent of the employers paid for training seminars for employees, but 14.23 percent of employers offered no training at all for their employees. Only a small number of builders provided any initial formal training for employees (7.98 percent).

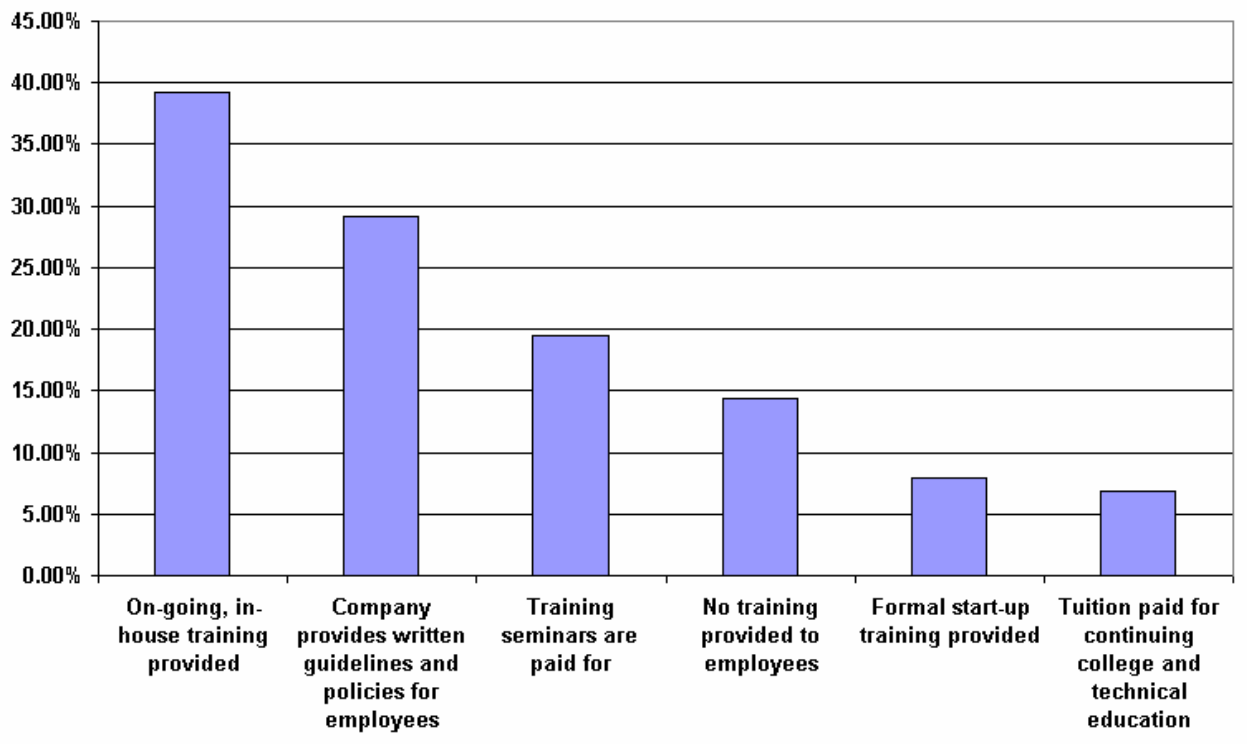

Figure 9. Employee Relations.

Conclusions

An important part of company management is for companies to compare themselves with similar businesses. Standards of the industry for financial performance are published to allow business owners to compare their competitors' operations to their own. In the same way, it is important to evaluate a management blueprint based on industry standards.

This study provided insights into the management practices of small-volume home builders in the United States. Most of the respondents focused on their product and on developing excellent home buyer relationships. A smaller amount of effort and time was spent on the development of internal (employee, subcontractor, and supplier) relationships and business planning. The respondents spent less than one percent of their revenues on advertising. Most of their sales were the result of word-of-mouth referrals and Realtor involvement.

Construction scheduling consisted mainly of "to-do" lists that were updated weekly. It was found that builders used a variety of methods to compile their estimates. The preferred method of estimating was to use detailed quantity take-offs. Using subcontractor and supplier bids was also

an important method in compiling estimates. Software applications that were used most often by builders were word processing, general accounting, electronic spreadsheets, and job costing.

In summary, this study provides a basis of comparison for small-volume home building companies, allowing owners to evaluate their own management practices. The study also lays an academic foundation for future research into investigations of management practices for the home building industry. Eventually, by pinpointing specific practices used by home builders of all sizes, researchers can expand upon existing knowledge to determine how management systems affect other businesses.

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Distance Education with Internet2 Audio/Video Technology

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The construction industry has changed enormously over the last 20 years and so have the tools used to manage the delivery of today's construction projects. Students, as well as current industry professionals, are finding it necessary to master these new processes, particularly those that affect communication and the handling of information, or they will be left behind. Creating new courses and continuing education classes that address this issue is a major concern. Designing courses that fit today's busy schedules and allow students to attend classes in non-traditional ways is a primary challenge for construction educators. The curricula of university programs must be adjusted to meet these changing needs. New tools are now available to help make these changes possible. Simple, fast and portable technologies can now be used to economically implement audio/visual connections between remote sites. These technologies allow distance learning to be an integral part of the solution and to meet the current needs of the industry.

Key Words: Distance learning, Internet 2, graduate education, integrated services digital network (ISDN), bandwidth, internet protocol (IP), multipoint conferencing, mixed conferences, multipoint control units (MCU), video private network (VPN).

Introduction

Computer technology is an essential part of virtually every industry today, and the construction industry is no exception. Computer software for planning, scheduling, estimating, drafting, and accounting is rapidly becoming an industry standard. College graduates entering the workforce, as well as current industry personnel, must be proficient with computers to keep pace with ever-changing technology. Consequently, the construction industry is demanding that graduates have some background in computer applications for all phases of construction. It is becoming more common for the construction professional to return to college for this training, especially at the master's level. Due to time and geographic restraints, this is virtually impossible for many.

Construction educators must take the lead in promoting computer literacy in their curriculums, and continue to develop new courses, delivery styles and software applications through continued research activities. Assessing the current and future needs of the construction industry, educators from the University of Nebraska-Lincoln's (UNL) Department of Construction Management and educators from Colorado State University (CSU) believe the time has come to educate not only within the classroom setting, but also to advance technology through distance learning. This bold step has only recently become a reality with the latest Internet 2 audio/video technology and software that is currently available. Recognizing this, UNL's Department of Construction Management has already constructed a Distance Learning Computer Facility using this simple and portable technology.

Technology Background

Television has penetrated societies throughout the world as a non-interactive display device for combined video and audio signals. Interaction or video conferencing has been accomplished through expensive satellite feeds or through the integrated services digital network (ISDN), technologies that are affordable to only a minority of potential users. Even with these high-tech pieces of equipment, “interaction” can mean that one of the active parties benefits from the use of satellite audio and video feeds while the other party in the communication is restricted to telephone audio feed. Coming to the rescue is an affordable, impending convergence of three digital technologies -- namely the high bandwidth Internet2, computer equipment with very-high-definition screens and advanced internet protocol (IP) bridging.

Internet2 has the advanced capabilities of data communications but at lower costs. Internet2 is a high-performance network that uses an entirely different infrastructure than the public Internet. There are already more than 200 universities and scientific institutions, and more than 60 communications corporations in the Internet2 network.

Most of the institutions on the Internet2 network are connected via Abilene, a backbone that supports a throughput of 10 gigabits per second (see Figure 1). Abilene is an advanced backbone network that connects regional network aggregation points to support the work of Internet2 universities as they develop advanced Internet applications. The network has become the most advanced native Internet protocol backbone network available to universities. There are also several international networks that are connected to the Abilene's infrastructure, and as the project grows, more and more networks will be able to connect to the current framework. All of the original project's members are actively participating in the development and testing of new applications and Internet protocols.

Abilene is named after a railhead established in Abilene, Kansas during the 1860´s. In its time the ambitious railhead of the 1800's staked a claim on what was then the frontier of the United States; the Abilene Project establishes a foothold from which to explore and develop pioneering network technology. The links of last century's railway changed the way people worked and lived. The 21st Century’s electronic railway will likely do the same. (Abilene, 2003).

The group's emphasis is on research and collaboration, focusing on things such as video conferencing, multicasting, remote applications, and new protocols that take advantage of the many opportunities mega-bandwidth provides. The excitement is about the 10 Gbps worth of data-moving bandwidth.

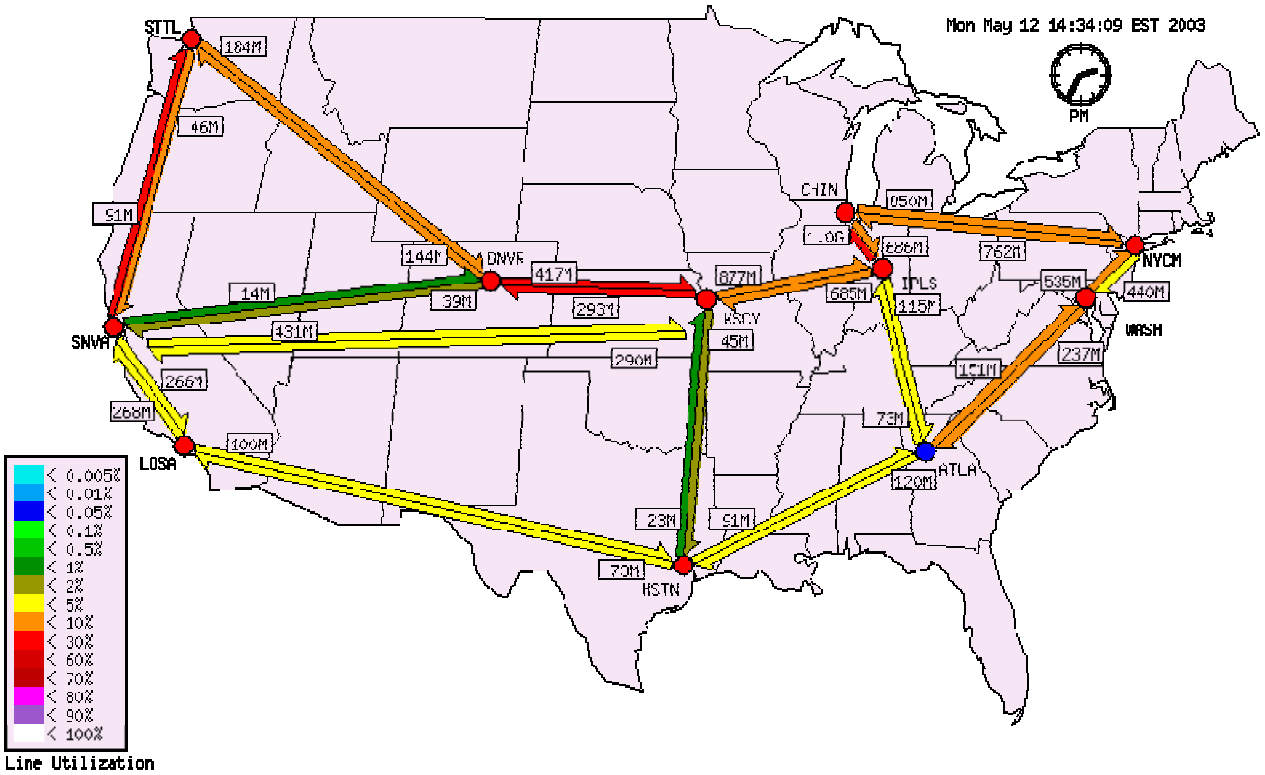

Figure 1: The 10 Gbps Abilene Backbone Network

The bandwidth for placing Internet2 - H.323 calls is based on the call-quality math of switched circuit networking. The math is based on the division of bandwidth into 64-Kbps increments or one DS0. A standard H.320 ISDN line is composed of two 64-Kbps DS0s for a total bandwidth of (2x64 Kbps) = 128 Kbps transmission. This does not include a signaling channel. Most businesses and educational video communications use 384 Kbps. Over ISDN, this requires six DS0s (or 6 x 64 Kbps – 384 Kbps) and requires an equivalent monthly expense of 6 separate telephone lines for a business or educational unit. The Internet2 H.323 counterpart requires a single line 100 Mbps Ethernet connection. (O'Neil, 2003). A speed/bandwidth comparison is given in Table 1.

With the breakthroughs in new multipoint conferencing systems and significant ease of use and performance enhancements in multipoint control units (MCU, also referred to as "bridges"), an IP real world voice and video system will detect industry standard firewalls and receive H.323, H.225 or H.245 signals with sufficient (and lower) bandwidth to accommodate rich media sessions. There is little to no network delay due to call set-up or maintenance. In addition, a video private network (VPN) with end firewalls has the ability to route calls, manage dozens of simultaneous sessions, and interoperate with many third-party H.323 entities and data networking devices. It is expandable and is comparable to telephone and data network services.

Table 1

Dialing Speed and Bandwidth Comparison of ISND and IP

Call Quality or Dialing Speed	Bandwidth Required over ISDN (H.320)	Bandwidth Required over IP (H.323)
128 Kbps	1 Basic Rate ISDN (BRI) line	153 Kbps
256 Kbps	2 BRI lines	307 Kbps
384 Kbps	3 BRI lines	460 Kbps
512 Kbps	4 BRI lines	614 Kbps
768 Kbps	Fractional TI or full Primary Rate ISDN (PRI) line	922 Kbps
1.5 Mbps	1 PRI line	1.843 Mbps
2.0 Mbps	Multiple PRI lines or E1 line (Europe)	2.4 Mbps

Usage Scenarios and Architecture

It is important to understand just how this type of technology affects the network administrator and the user of the service. The combination of MCUs and a gateway to provide multiple protocol intercommunications can offer the following usage scenarios for internal videoconferences over VPN tunnels.

- IP Point-to-Point Conferences – A single terminal calling another terminal or calls can be placed between any H.323 IP desktop and/or group system in a point-to-point conference using the VPN technologies.
- IP Multipoint Conferences – H.323 IP-based multipoint conferences to and from any desktop and/or group system may be placed with IP-based MCU products.
- IP & ISDN Mixed Conferences – IP & ISDN mixed point-to-point conferences may be placed to or from H.323 IP-based desktops and/or group systems using a protocol gateway.

The most common implementation is point-to-multipoint, using multiple protocols. This setup is ideal for Internet2 networking especially since the H.320 technology has slowed and moved toward the more dynamic and economical IP infrastructure. In deploying a video communications system, one must understand video communications infrastructure and network variables to evaluate terminals, gateways, MCUs, etc. An advanced complete learning solution was designed by UNL telecommunications staff in a “user-friendly” format that could be easily and economically integrated in the larger classroom. With multiple controls, cameras, microphones, and instructional tools, the best available solution was directed towards the Polycom® systems, due to their ability to take full advantage of distance learning technology at a reasonable price. The completed system allows complete interaction, from simple communication to sharing complex data and computer software (see Figure 2).

Polycom’s® revolutionary unified conferencing system created a single platform that enables people to combine audio, video, and web conferencing in a single meeting over any type of network (see data specifications in Appendix A). The cost was extremely reasonable (compared

to ISDN systems), and the installation was flexible enough to accommodate the physical attributes of the classroom.

UNL has equipped a distance learning facility with 20 computer stations and tied them into a mainframe computer. The stations are strategically located to enable each student to have an unobstructed view of a large (7'x 8') centered projection screen and two left/right 56" Sony televisions located in the front of the classroom (see Figure 3). The heart of the system is an IP2 broadband audio/video system by Polycom®. The class lecture itself can be as sophisticated as the instructor wants it to be by utilizing computer software, PowerPoint® presentations, overhead projected materials, electronic white board, television/cable broadcast, or VCR/DVD programming. Students at UNL's end can manipulate the software at their individual stations while viewing the on-screen instruction. The screen image can be transmitted to multiple designated sites off campus such as contractors' offices, universities, technology centers and even wireless laptops where the interactive process of a live lecture can be offered.

Incorporating Internet2 Technology into Distance Learning

Rapid technological advances in communication are changing the traditional process for conducting business (Antevy, 1998; Emond, 1999; Hmelar, 2003; Orth, 2000; Schexnayder, Wiezel, & Seneviratne, 1999; Wacome, 2003). As a result, organization and documentation of information for the Internet environment requires special attention to how an audience will interact with the data (Tufte, 1990; Zaneldin, 2001). This applies not only to industry but also to any academic program development.

To be successful, one must understand the verbal and graphic operations of presentation that are currently conducive to distance learning. Many construction management programs across the United States are finally bringing distance education into reality. Some examples are:

- The collaboration between the University of Oklahoma and East Carolina University to develop an online delivery system for a design-build class. The team used a fire substation in Las Vegas, NV as the class project. Programming studies, site development studies , preliminary and final material research, code analysis, preliminary schematic designs, structural design, preliminary cost and scheduling, value engineering and final design development were all funneled into the class using Internet technology. They have plans to extend the course offering to students at Augsburg in Augsburg, Germany (Batie & Connell, 1999).

- In the Department of Civil Engineering and Construction at Bradley University, Peoria, in Illinois, they have developed a course using online learning tools to teach construction scheduling. Using tools ranging from scripting and programming languages to simple WYSIWYG (What-You-See-Is-What-You-Get), they have developed a new paradigm of "lecture-on-demand" as a part of the now recognized framework of Asynchronous Learning Networks (Nassar, 2001).

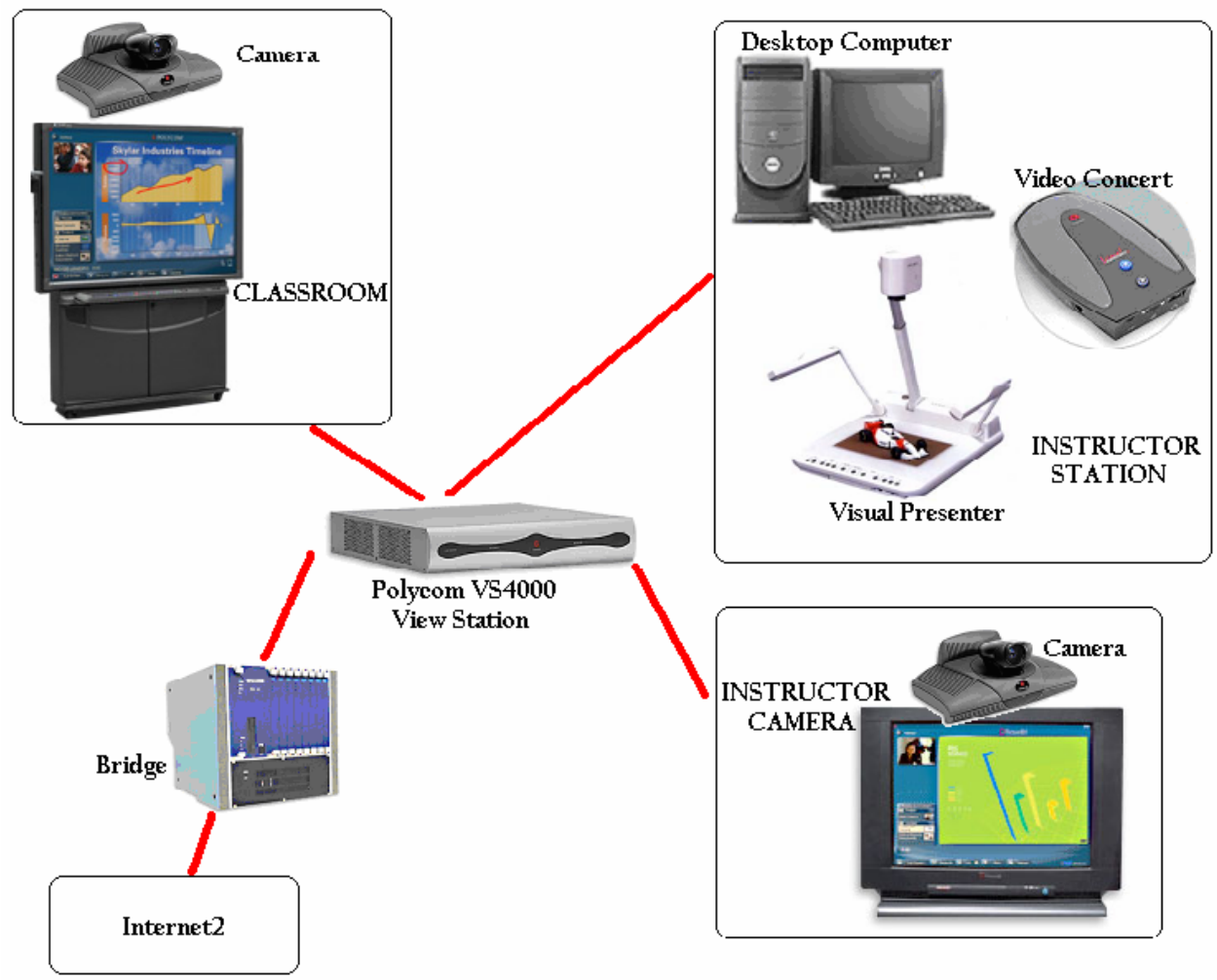

Figure 2: Real Time Video and Audio Solution for Internet2

Figure 3: Actual Classroom Configuration Using the Polycom® Solution

- There was a pedagogical cooperation between the University of North Florida and The American University using the new avenues of the World-Wide-Web technology through the Florida Engineering Education Delivery System (FEEDS). It is a system that was created to deliver academic programs to place-bound engineers throughout the state of

Florida. This statewide system is providing access to graduate- and undergraduate-level courses at corporate sites and cooperating university centers. Place-bound engineers have access to degree programs, courses and certificates (Malek, 2003).

- The University of Oklahoma in Norman Oklahoma is offering interactive online construction education experiences. They have developed a course that has an automated self-paced interactive format. It works by combining animation, video and audio to overcome or minimize the perception of a correspondence class. Overall results seem to capture the imagination of the student by reinforcing necessary concepts just as well as a "good" instructor would do in the traditional lecture format (Ryan & Kasturi, 2002).

- Classes are being taught successfully using UNL's distance learning facility within Lincoln-Omaha campuses and between colleges on the Lincoln campus. Collaboration of teaching have been successful with Harvard, Texas A&M, and Arizona State. Future plans are to extend this same type of graduate education into a 36-hour Master of Engineering in Construction program by fall 2004 with the collaborative efforts of UNL and CSU.

Discussion

Distance education is increasingly being delivered using combinations of the various tools previously mentioned. This forces an approach to teaching that requires breaking it into two constituent parts: instructor training and curriculum development.

Instructor Training

A review of the literature demonstrates that distance education through computer networking and related technologies is creating a paradigm shift in education away from the traditional teaching-learning transaction (Davison, 1996; Filipczak, 1995; Harasim, 1996; Kerka, 1996; Moore, 1995). The trend shows that the delivery of instruction is being shaped by microcomputers, the Internet, and the World Wide Web and that distance educators are facing enormous challenges (Kerka, 1996). These systems can be great, but caution is considered necessary. As noted by Williamson (2001), there needs to be real educational value beyond the use of technology. He discovered that most curriculums are written and presented in a teacher-centered format, not student-centered. Initially, most faculty members seem to view technology as just a simple aid to their existing teaching strategies. This attitude toward this new technology must, at a minimum, be expanded if not ultimately changed, in order to take advantage of this new teaching format.

There are an added number of issues that arise that are affiliated with the change in teaching and learning format by the use of distance education. The most frequently-mentioned issue is the need for faculty development (Davison, 1996; Filipczak, 1995; Thach & Murphy 1995; Warren, 1995). This is due to the fact that traditional lectures will not function in a distance education setting. If educators are not trained in facilitating greater student participation and interaction, the

end result would be a class that simply imitates familiar teaching situations and strategies, creating little student involvement at the far end (Davison 1996).

Thach and Murphy (1995) conducted a study of 100 distance educators that demonstrated a need for teaching development in distance education. They compiled a list of competencies that are needed to prepare the instructor for the distance-learning environment. These “top ten” competencies illustrated the dual importance of communication skills and technical skills as follows:

1. Interpersonal Communication
2. Planning Skills
3. Collaboration/Teamwork
4. English Proficiency
5. Writing Skills
6. Organizational Skills
7. Feedback Skills
8. Knowledge of Distance Education Field
9. Basic Technology Knowledge
10. Technology Access Knowledge

Curriculum Development

Course design is determined by the educator’s technological skill sets. Content and mode of delivery are key issues of the development of any distance class. However, it is important that instruction, no matter the skill set, is designed to promote continuous learning in an engaging format. Distance learning technology does not lend itself well to changing methodology once a class session has begun. With this in mind, there appears to be a need for distance teachers to stay with the "prepared script" by designing distance education courses with high levels of organization that can control the input and output of the learning environment. Moore and Thompson (1990), along with Williamson and Burt (2001), caution against the use of technology for technology's sake. They insist that decisions should be based on instructional needs and goals and then on professional and technical expertise.

There are four “teletechniques” that were first introduced by Parker and Monson (1980) and then described in more detail by Moore and Thompson (1990). These principles of instructional design are taken for granted in the traditional face-to-face lecture format but can become lost in distance education with disastrous results. The first is to keep students from becoming “dehumanized” by the distance technology. The instructors must maintain a rapport with their students by creating an atmosphere that fosters relationships. The second is participation as it relates to interaction among the students within the audio/video classroom. Multiple broadcast sites can be a challenge. The third is the message style in which the instructor creates strategies to generate student interest and appeal in the lecture or discussion. Finally, they identify the fourth principle as feedback. This is crucial for the instructor to determine the level of effectiveness of the distance learning process.

Conclusions

Distance education can now be delivered in an economical and "user-friendly" format. The distance communication gap has been bridged for the instructor and student; however, care must be taken not to inhibit classroom interactions and relationships. Instructors need to be reflective in their pedagogical principals and adjust their teaching style in a manner that is conducive to student learning. They need to be aware of the psychological, social, and technical obstacles that distant learners face. As for the distance students, logic would dictate that they will have to take more responsibility for their own learning. To be a successful learner, they will have to partner with the instructor to overcome the obstacles that are inherent to the distance-learning environment. The distant students must also overcome the intimidation of using the technology to interact with the class on a voluntary basis.

Trends indicate that in the future there will be an increase in the volume of students that enroll in distance learning programs as well as changes in the type of delivery systems that will be used. However, it needs to be noted that distance education is not, and will not be, for all teachers and students.

Recommendations

It is recommended that both UNL and CSU do an evaluation of resources that will allow them to determine the strategies in managing a simple "in-house" pilot project. This project would use one course for distance education at the departmental level (i.e. use the equipment in two separate and distinct classrooms with two groups of students). Using the information gathered from this initial project, both universities then could move toward the development of one trial graduate course to be taught between the universities.

Assessment can be made and lessons can be compiled for the development and employment of a larger-scale, 36-credit-hour graduate program. This development must address the mission, a needs assessment, goals and action plans, budgeting and evaluation of the program. To insure that the distance learning system develops in the most beneficial ways, it must be recognized as being consistent with and supportive of the culture and mission of all parts of the involved institutions. Management and administration of the program must also include the provision for evaluation which gives all of the stakeholders involved a method or methods by which they may determine if the goals and the mission of the distance master's program has been met. In addition, a reserve fund analysis is needed to determine service and update needs of the audio/visual system on both sites. These systems must be kept current in order to fully utilize the potential of these new and ever-changing technological advances.

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Appendix A

ViewStation 4000

ViewStation 4000 delivers near TV-quality video and superior audio to meet the most demanding video communications needs for custom conference rooms, auditoriums, boardrooms, and classrooms.

Highlights

Designed for customization and integration—The ultimate in performance, interfaces, and control for custom room integration

The industry leader–The most popular and widely deployed group video conferencing platform in the world

Superior video quality–With ITU standard, 60 fields per second, letterbox near TV-quality video, and Polycom Video Error Concealment (PVEC) designed to counter real-world network packet loss

Clear 360-degree, full duplex digital audio–With noise suppression, echo cancellation, and automatic gain control

Maximum call flexibility–Support MPPlus conferences with up to 14 video and audio sites through the embedded MCUs when cascading (10 sites on any mix of IP or ISDN, plus four regular telephone connections)

See presenter and live, high-resolution multimedia presentation–People+Content™ displays video of the presenter along with live, high-resolution XGA PC graphics and sound between ViewStation FX, ViewStation 4000, iPower™, and MGC bridges

Built-in automatic MPPlus presentation modes–Display modes automatically switch between presenter and continuous presence–like a live TV news show

Security you can trust–Independently verified and tested for secure use in corporate and classified environments. Polycom video conferencing and collaboration systems provide advanced technology specifically designed for video conferencing, including superior audio pickup with 360-degree microphone that enables meeting participants to be heard from anywhere in the room. Polycom's interface is easy to use, with on-screen graphics, and easy to navigate with color-coded remote controls. Going beyond face-to-face meetings, laptops can be quickly connected to Polycom video systems with dedicated devices that make sharing content as easy as pushing a button. These high-quality Polycom systems are all part of The Polycom Office.

High-quality video communications for The Polycom Office™

Technical specifications

ITU H.323 and H.320 compliant

- Cisco AAVID certified

The Polycom Office experience

- People+Content™ allows dual display of video and PC graphics
- Conference on Demand™ initiates unscheduled MGC calls from the endpoint
- Call Detail Records enables billing of calls and tracking with Global Management System
- Polycom Video Error Concealment (PVEC) for improved video quality on networks with packet loss
- Global Management System for centralized management
- Global Directory Server for live global address book
- PathNavigator for easier call placement and network cost optimization
- MGC Click &View integration for individual screen layouts

User interface

- User-friendly graphical user interface that is easy to read from a distance
- Handheld, ergonomic remote control
- Custom logo on home screen with speed dial numbers
- Web interface (Internet Explorer 5.5 & 6.0; Netscape Navigator 6.0 & 6.1)

Bandwidth

- Max Data Rate H.320: up to 2 Mbps
- Max Data Rate H.323: up to 2 Mbps

Video standards

- H.261, Annex D
- H.263+ Annexes: L, F, T, I, J, U, u
- H.263++ Annex D
- ITU 60 fields per second letterbox
- 1 x video out for projector up to 1024 x 768, 60 Hz
- 3 x 10/100 Ethernet hub

Other content input options

- pc Presents for Microsoft PowerPoint presentations from your desktop
- Polycom SNAP for high-resolution graphics capture of PC content

With integrated video, voice, data, and Web capabilities, The Polycom Office is the only solution that offers you an easy way to connect, conference, and collaborate any way you want. It's our commitment to making distance communications as natural and interactive

Video features
4 monitor support to simultaneously display full-screen video from up to 4 endpoints plus PC content on a separate XGA projector Automatic VCR recording of all endpoints based on the person who is talking Automatic Picture-in-Picture (PIP)

Video inputs (7 Inputs)
- 1 x MiniDin S-Video (main camera with PTZ control)
- 1 x MiniDin S-Video (document camera)
- 1 x MiniDin S-Video (second camera with PTZ control)
- 1 x RCA/Phono, composite (main camera)
- 1 x RCA/Phono, composite (document camera)
- 1 x RCA/Phono, composite (VCR)
- 1 x RCA/Phono, composite (second camera with PTZ control)

Video outputs (10 Outputs)
- 4 x MiniDin S-Video (Support for 4 independent monitors)
- 4 x RCA/Phono, composite (Support for 4 independent monitors)
- 1 x RCA/Phono, composite (VCR)
- 1 x XGA (projector)

Video formats
- NTSC, PAL, XGA, SVGA, VGA

Optional Polycom PowerCam external camera
- Ultra-quiet, ultra-fast Pan, Tilt, Zoom (PTZ)
- 65° Field of View
- Tilt Range: +/- 25° (up/down)
- Pan Range: +/- 100° (left/right)
- Total Field of View: 265°
- 12x Zoom; f-4.2 to 42mm
- F=1.85 to 2.9 mm
- Auto Focus
- Automatic White Balance
- 20 camera presets (10 local and 10 far end)
- Far end camera control

People+Content
- Dual images (transmits people and high resolution content simultaneously)
- Dual audio (transmits audio from room microphones and PC simultaneously)
- Available on IP and ISDN

Audio standards
- 7 kHz G.722, G.722.1
- 3.4 kHz with G.711, G.728Audio features
- Instant Adaptation Echo Cancellation
- Automatic Gain Control (AGC) – voice activated
- Automatic Noise Suppression (ANS)
- Built-in tonal speaker test
- Audio level meter
- Audio mixer
- Telephone POTS support
- Ability to talk over VCR audio

Digital tabletop microphone
- 360° voice pick-up, unidirectional performance
- Automatic room noise reduction
- Gated mixer built into microphone
- 3 hyper-cardiod microphones in each microphone pod
- Button on each microphone pod
- Includes 2 microphones pods
- Can be mounted to ceiling or walls

Audio inputs (4 inputs)
- RJ-9 to microphone (daisy chain up to 2 microphone pods)
- 2 x RCA / Phono line level (VCR)
- 1 x RCA / Phono line level (Mixer/Auxiliary)

Audio outputs (4 outputs)
- 2 x RCA / Phono line level (main audio)
- 2 x RCA / Phono line level (VCR)

Frame rates (point-to-point)
- 15 fps – 30 fps
- Intelligently selects frame rate for best video performance
- Near TV-quality letterbox 60/50 fields video for NTSC/PAL at 512 Kbps and above

Embedded MPPlus
- Supports mixed combinations of IP, ISDN, and analog telephone calls
- Supports IP telephones
- Supports normal analog telephones
- Automatic IP and ISDN downspeeding
- Dial-in and dial-out during MPPlus calls
- Continuous presence or voice switched
- Automatic MPPlus Presentation modes to automatically switch between presenter and continuous presence modes
- Chair control from endpoints or host system on IP
- Chair control from endpoints or host system on ISDN
- Embedded MPPlus for 5 sites (4 IP/ISDN sites + 1 POTS audio)
- Cascade up to 14 sites (10 IP/ISDN sites + 4 POTS

- Works from any endpoint with embedded MCU (not just host site)

Live people video resolution
- 4CIF (704 x 576)
- CIF (352 x 288)
- QCIF (176 x 144)

Live PC content resolution
- XGA (1024 x 768)
- SVGA (800 x 600)
- VGA (640 x 480)
- 4CIF or CIF for S-Video and composite inputs

Still image transfer
- CIF, 4CIF (H.261 Annex D), 16 CIF High resolution (H.263)

Optional Visual Concert™ FX
- Tabletop device (for audio and video input from PC or Macintosh)
- Input: up to 1280x1024, 60 Hz
- Output: up to 1024 x 768, 60 Hz
- 1 x audio input for PC
- 1 x video input for PC up to 1280 x 1024, 60 Hz
- Software upgradeable Inverse Multiplexer (IMUX)
- Auto SPID detection and configuration
- NATO standard KG-194/KIV-7 encryptor support with on-screen and address book dialing
- Polycom Global Address Book integrates with Active Directory/LDAP
- Automatic ISDN localization of calls
- Dial ISDN lines separately or simultaneously

Quality of service and experience - iPriority™
- Polycom Video Error Concealment (PVEC) for concealing packet loss
- IP Precedence (ToS)
- DiffServ DHCP (CoS)
- Dynamic bandwidth allocation
- Proactive network monitoring
- Packet and jitter control
- Network Address Translation (NAT) support
- Automatic NAT discovery
- Asymmetric speed control
- Fixed TCP/UDP port firewall support
- Lip synchronization
- Echo cancellation
- Echo suppression
- Auto gatekeeper discovery
- Automatic gateway dialing profiles
- Specify outbound call routing for gateway/ISDN
- Closed captioning and text chat support both in and out of calls

audio)
- Mixed network cascading
- Password protection for incoming calls
- Supports People+Content dual streams from any endpoint (not just host site)

Network features
- Automatic H.320/H.323 calling
- Downspeeding over IP and ISDN
- OneDial intelligent call management attempts call on preferred network (IP or ISDN) and automatically rolls over to secondary network if needed
- Maximum call length timer
- Live address book with Polycom Global Address Book automatically and quickly removes endpoints from directory if they are turned off

System management
- SNMP management
- Software upgrades via PC, IP, or in a ISDN video call
- Integrated Web server for remote management and Microsoft PowerPoint presentations
- Remote administrator video-only monitoring of room or calls from integrated Web server (enabled/disabled from endpoint for security)
- Built-in extensive Call Detail Records (CDR) that do not require separate external management system
- Account number validation at call initiation integrated with Polycom
- Global Management System for billing purposes
- Administrator configurable dialing speeds
- Complete support for The Polycom Office including:
- Polycom Global Management System
- Polycom Global Address Book
- Polycom OneDial
- Polycom PathNavigator

Other ITU supported standards
- H.221 communications
- Bonding, mode 1
- H.281 far-end camera control
- H.225, H.245
- Annex Q standard for FECC in H.323 calls

Data port
- RS-232 control port/data communications port (1200 baud to 115k baud asynchronous)
- API for custom integration with remote devices such as Crestron™ and AMX™ control systems

Electrical
- Auto-sensing power supply
- Operating voltage/power 90-260 VAC, 47-63 Hz/40

- Keypad audio confirmation – makes dialing easy

Security features
- Independently tested for endpoint security
- Enhanced integration for independently certified corporate and classified encryption devices
- Secure password authentication
- Unique factory default passwords
- Dial-in meeting password
- Do not disturb meeting feature for point-to-point
- Do not disturb meeting feature for MPPlus calls
- Select which menu screens to password protect
- SNMP security alerts for failed and successful password authentication attempts
- Option to disable remote interfaces (FTP, SNMP, Telnet, HTTP, Streaming)
- Option to disable mixed protocol MPPlus calls

Network interfaces supported
- 2 independent 10/100 Ethernet ports for IP (LAN, DSL, cable modem)
- Integrated Ethernet switch
- 1 x POTS for voice
- Optional Quad BRI (Basic Rate Interface)
- Optional PRI (Primary Rate Interface) T1/ E1
- Optional 2-port Serial Module (V.35/RS-530/RS-449 with RS-366 dialing)
- Optional wireless LAN support via Ethernet port

Ethernet connectivity
- TCP/IP, HTTP, DNS, WINS, SNMP, DHCP, ARP, FTP, Telnet
- T.120 interface for Microsoft Netmeeting
- Internal live video unicast or multicast stream to Apple Quicktime, Cisco IP/TV, etc.

Directory services
- 1000+ number local directory
- 10,000+ number global directory
- Unlimited MPPlus entries
- Live address book with Polycom Global Address Book as being there. Work faster, smarter, and better with the ViewStation 4000 and The Polycom Office.

Polycom ViewStation 4000 Specifications
- Polycom video conferencing and collaboration systems support Polycom network infrastructure and management systems. With the Polycom MGC, Polycom video systems can participate in large multipoint conferences. Polycom PathNavigator™, among many other features, enables easy dialing from Polycom video systems with OneDial™.
- And video systems can be centrally managed and controlled with Polycom Global Management

watts

Environmental specifications
- Operating temperature: 0 to 40° C
- Operating humidity: 10% to 85% R.H. noncondensing
- Nonoperating temperature: -40 to 70° C
- Nonoperating humidity (noncondensing): 10 to 90%

Physical characteristics
- Dimensions (W/H/D): 43.8 cm x 8.8 cm x 46.7 cm
- Base Unit Weight: 4.7 kg/10 lbs

Language support
- Chinese, English, French, German, Italian, Japanese, Norwegian, Portuguese, Spanish

Warranty
- Three-year parts and labor

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Acknowledgement

The editor wishes to thank the Ira A. Fulton College of Engineering and Technology of Brigham Young University for its support of the *Journal's* operations.

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Industrial Members: shall be industrial organizations demonstrating a constructive interest in construction education. Annual member dues are $400.00 base membership or $650, which includes $250 for advertising industry positions on the ASC website. This service includes full-time, part-time, summer internship, and co-op program listings.

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