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Project Simulation in Construction Finance Education

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FINANCIAL FAILURES

More than 50 percent of new contractors fail in the first five years of operation. This paper addresses the 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, bench marking data from the Construction Financial Management Association (CFMA) and the Fails Management Institute (FMI) have been complemented by input from 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 operation.

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 prior (2000-2002) and four semesters following (2003-2004) 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 satisfaction improved nearly 30 percent when compared to evaluations prior to implementation of the case-study project.

Accounting and other cost control functions are among the most neglected business operations in contracting firms [7]. Many business owners have little financial background and fail to realize the importance of trade credit, accounts aging and cash-flow. In spite of overwhelming evidence that suggests financial misfeasance 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. One-third or less of the concentration is usually given to structures, project management and MEP coursework. In fact, many schools opt 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.

Since 1987, the U.S. construction industry has generated some \$6 trillion in sales, accounting for 4 to 5 percent of the U.S. gross domestic product each year [8]. Yet, in spite of being the nation's largest industry and largest source of employment, more than 50 percent of new contractors fail in the first five years of operation, most of these in the first two [7]. These "upstarts" usually have good field knowledge but have little knowledge of the business and financial environment.

New contractors often underbid 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 over-heads [7]. Those that are able to formulate a competitive and profitable pricing strategy may still fall prey to the "capitalization trap," where working capital and line of credit are insufficient to meet current liabilities and complete what otherwise would have been a profitable job [5]. Over capitalization, or the under utilization of favorable credit terms and debt leverage strands limited cash-flow and reduces return-on-investment [5]. Other pitfalls include an inadequate understanding of the time value of money, allowing the contractor to make poor investment and financing decisions.

COMPETITIVE PRESSURES

The costly and adversarial notion of "checks and balances" between owners and contractors under traditional design-bid-build has since given way to new delivery methods focused on accountability, value and client retention [4]. Invited bid, CM and design-build have emerged as effective alternatives for a new age of owners 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, more than hard bid and CM at-risk delivery methods combined [4]. This trend shows that owners will increasingly turn to the contractor to provide among

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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 licensure understand that the individuals responsible for a construction should have minimum competencies, bonding and financial standing to protect the public from economic loss. Although human health and safety remains the most obvious priority, 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 [3].

STEPS TO SUCCESSFUL CURRICULA DEVELOPMENT

Industry Output

The Building Construction Executive Advisory Committee (EAC), a nationwide cross-section of 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 courses. A focus group review of the undergraduate Construction Financing course conducted in August 2002 identified key financial competencies needed of construction program graduates, from entry-level positions to executive management and business ownership. Finance related issues industry participants felt had the greatest impact on the bottom-line or were largely neglected during their educational experience included:

- Construction loan agreement, lien subordination, retainage, material changes in contract.
- Pro forma, financial ratios, and progress billings; importance in securing line of credit, project financing and bonding capacity.
- Labor burdens such as Worker's Compensation rates, modifiers, classifications, frequency and severity issues and how they impact cost to the contractor.
- Professional licensure and finance-related examination content.
- "Best in class" financial bench marking and comparative analysis.

Project Simulation

Using industry recommendations and Construction Financial Management Association (CFMA) and the Falls Management Institute (FMI) bench marking criteria, key compe-

tencies for successful financial management and business operation were identified. A semester project was developed as an instructional medium and as a cumulative case study of key competencies learned in project financing and business start-up and operation with the goal of developing a successful project financing package as well as company pro forma and business plan.

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 where 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 from cumulative lectures and assignments that would embody the key financial competencies identified by industry.

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, 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 US where they planned to build. Students were also asked to provide a detailed construction estimate on take-off items they planned to self-perform and work to be let 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.

Next, groups were instructed to develop a project budget using income capitalization. Project estimates that exceeded the project budget were adjusted accordingly through various combinations of scope reduction, value-engineering and lease rate adjustments. 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) ratio, 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 able to assemble a project feasibility analysis that would compare the project return-on-investment to the student's minimal attractive rate of return (MARR). This was defined as the weighted-average cost of capital (WACC) adjusted for risk, inflation and spread. 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)—The Associations of Builder's and

Table 1—Results of simulated State of Florida general contractor licensing exam, business and financial management section, 2002-2004.

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%
Spring 2004	50	48 (96%)	2 (4%)	89%
Fall 2004	61	61 (100%)	0 (0%)	89%
TOTAL	292	282 (97%)	10 (3%)	88%

Note: Passing score \geq 70%

Contractor's Institute (ABCI) manual titled "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 markups. 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 able 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 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 aging to actual construction firms considered "based in class" by CFMA's 2003 Annual Construction Industry Financial Survey.

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 as much on the financial strength of the company as the project and that the business plan and pro forma 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 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 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 would be used as a basis for project grading, which in addition to individual assignments, would constitute 40 percent of their final course grade.

Part IV: Final Examination—Students were also tested on 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. 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 project implementation process.

OUTCOME ASSESSMENT

A knowledge assessment survey was administered to students enrolled in the Construction Financing course at the beginning of each semester starting in Spring 2004 and again at the end of the semester to assess cumulative skills obtained. Questions were developed from key competency topics identified from industry input and subsequently adopted into the construction financing curricula using the project case study (table 2). Respondents were asked to assign a value of 1, 2 or 3 to a total of 10 questions if they 1—could not answer a given question, 2—could partially answer a given question or 3—could completely answer a given question.

Table 2--Knowledge assessment survey topics.

Question	Key Competencies Surveyed
1	Weighted average cost of capital (WACC), net present value (NPV), internal rate of return (IRR)
2	Loan to value (LTV) ratio, income capitalization
3	Effective interest, compensating balances, commitment fees, points
4	Schedule of values, draw schedule, interest carry, interest reserve
5	Pro forma, general journal and ledgers, financial ratios, bonding capacity, credit rating
6	Cash and accrual accounting, income recognition
7	Cash flow and working capital
8	Price, volume and profit, fixed and variable costs, break-even point
9	Burdened labor, bid preparation, mark-ups
10	Depreciation and equipment

Table 3--Results of incoming knowledge assessment survey, 2004.

Question	1	2	3	4	5	6	7	8	9	10	Average
Spring 2004											
Mode	1	1	1	1	1	1	1	1	1	2	1.10
Mean	1.11	1.15	1.33	1.52	1.11	1.57	1.39	1.11	1.17	1.93	1.34
Fall 2004											
Mean	1	1	1	1	1	1	1	1	1	2	1.1
Mode	1.07	1.07	1.26	1.39	1.23	1.35	1.14	1.02	1.14	1.61	1.23
TOTAL	1.09	1.11	1.30	1.46	1.17	1.46	1.27	1.07	1.16	1.77	1.29

Table 4--Results of outcome knowledge assessment survey, 2004.

Question	1	2	3	4	5	6	7	8	9	10	Average
Spring 2004											
Mode	3	3	3	3	2	2	2	3	3	3	2.70
Mean	2.56	2.36	2.67	2.67	2.31	2.33	2.33	2.28	2.11	2.61	2.42
Fall 2004											
Mode	2	2	3	3	2	3	2	1	2	3	2.30
Mean	2.28	2.30	2.77	2.63	2.21	2.67	2.07	1.49	1.70	2.53	2.27
TOTAL	2.42	2.33	2.72	2.65	2.26	2.50	2.52	1.89	1.91	2.57	2.35

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 curricula development.

Results of the student outcome assessment survey 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 3). 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 4).

Based on an average entrance skill level of 1.29 out of 3.00 points possible, survey results showed an average increase of skills attainment of 1.06 points or an average exit skill level of 2.35. As

a result, student knowledge of financial competencies identified as key by the EAC focus group and literature review improved 82.2 percent in relation to the student's skill level entering the course, or, 62.0 percent of the remaining 1.71 improvement points possible.

Course evaluations for three consecutive semesters prior to 2000-2001 and four semesters following 2002-2004 project implementation (n = 283) were also compared to assess the change in student satisfaction following project simulation. Of 19 questions total, questions one through nine pertained to qualitative instructor attributes such as communication skills, respect for students, stimulation of interest, student encouragement and enthusiasm for the subject. Questions 11-19 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 asked students to

rate the instructor. Respondents were given values ranging from one to five, 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 assumed

that changes in student perceptions would likely be the result of implementing the project financing case study.

On a standard scale of one to five, student satisfaction improved on average from 3.49 during 2000-2001 to 4.47 in 2002-2004. In addition to a 28.1 percent increase in mean teaching evaluation score, teaching methods improvements can be consid-

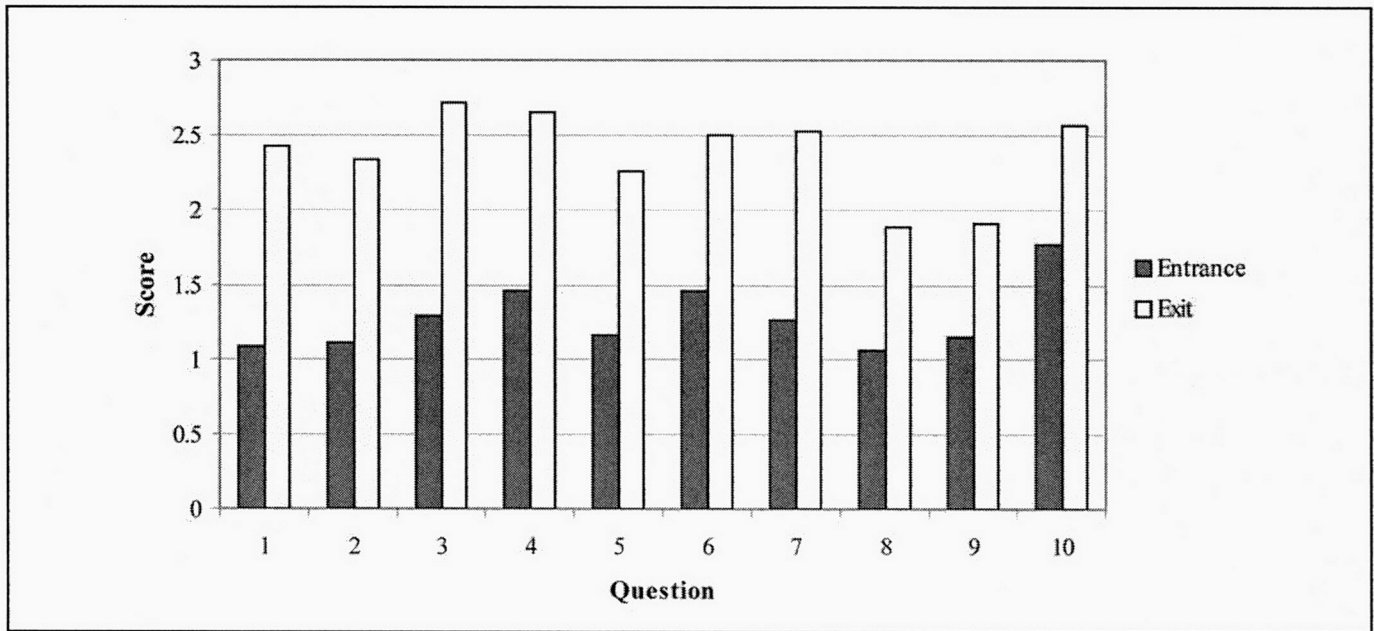


Figure 1--Comparison of incoming knowledge assessment and outcome knowledge assessment, 2004.

Table 5--Pre-implementation course and instructor evaluations for Construction Finance curricula, 2000-2001.

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
TOTAL	3.45	3.44	3.59	3.49

Table 6--Post-implementation course and instructor evaluations for Construction Finance curricula, 2002-2004.

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
Spring 2004	4.61	4.71	4.63	4.65
TOTAL	4.43	4.55	4.43	4.47

Note: Instructor did not teach course in Spring 2002.

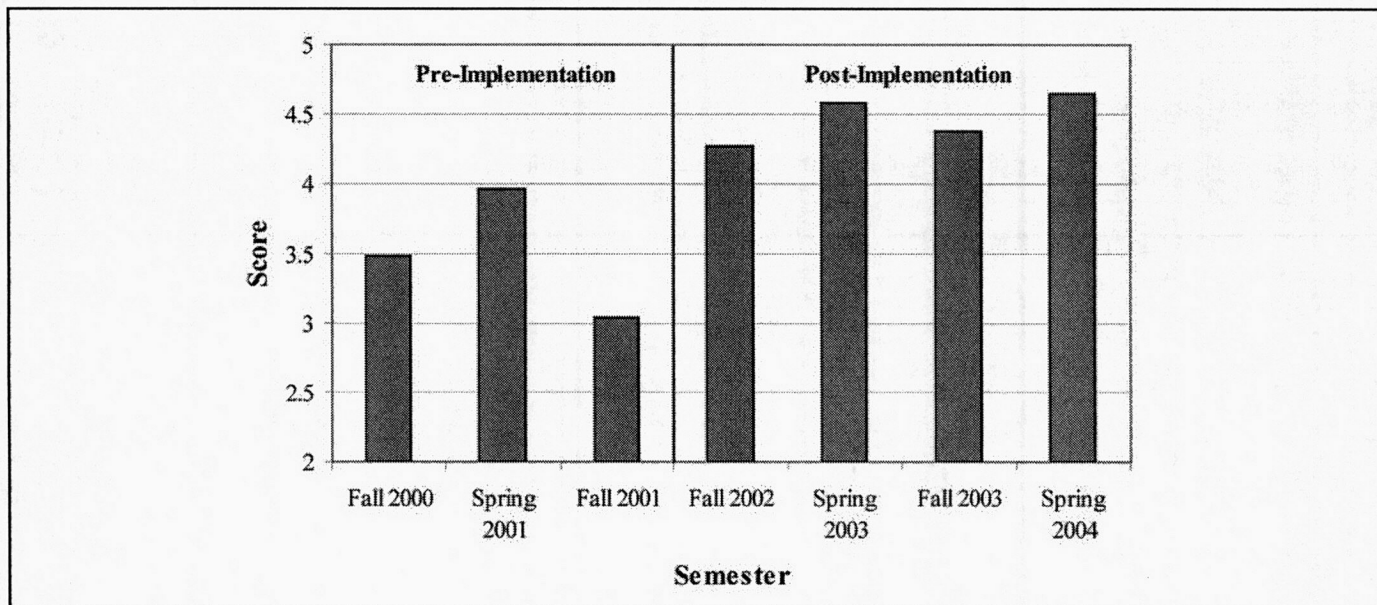


Figure 2--Comparison of student satisfaction, pre and post project case study implementation, 2000-2004.

ered responsible for 0.98 (64.9 percent) of 1.51 improvement points possible (tables 5-6).

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, plans reading and technical writing in a comprehensive. Students were also exposed to basic market research tasks and creative thinking. Perhaps most importantly, students were placed into an environment where teamwork and leadership skills could be cultivated and developed.

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