Development of a Pedagogy for

Preconstruction Tools and Practices

by

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A Thesis Presented in Partial Fulfillment
of the Requirements for the Degree
Master of Science

Approved August 2019 by the
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ARIZONA STATE UNIVERSITY

August 2019

ABSTRACT

The delivery of construction projects, particularly with respect to design phase or preconstruction efforts, has changed significantly over the past twenty years. As alternative delivery methods such as Construction-Manager-at-Risk (CMAR) and Design-Build models have become more prominent, general contractors, owners, and designers have had the opportunity to take advantage of the collaborative planning opportunities that exist during the preconstruction portion of the project. While much has been written regarding the benefits of more collaborative approaches and the utilization of various tools and practices during preconstruction to mitigate risk and maximize positive outcomes, what is lesser known is how to teach a coursework that exposes students to various tools and practices that are being utilized today. The objective of this research was to create a testable methodology that can be used to analyze a developed approach that answers the question of how to teach preconstruction tools and practices. A coursework was developed and taught as a graduate level class and data was collected from the actual teaching of that class. In addition, feedback was solicited from the construction industry concerning recommended content applicable to such a class. Data was then analyzed to ascertain student retention of the material and topical content of the course. Through these findings and literature review process the methodology and baseline coursework was shown as an effective means to teach preconstruction tools and practices.

DEDICATION

I would like to dedicate this thesis, and all of the underlying work associate with it, to my family. The first dedication is to my wife Michelle whose love, support, words of encouragement, and proactive efforts to create the time and space in which to work has been the fuel that I needed to accomplish this goal. I would also like to dedicate this thesis to our children residing at home, Jenna, Faith, Hannah, Josh, Noelle, and Holly who remained cognizant of the fact that their dad had much work to do in addition to his ongoing construction industry responsibilities, and always kept that at the forefront in the management of their own expectations. The last dedication is for our children who are out on their own, Nicole, Tyler, Andrew, and Ryan whose words of encouragement and moral support are acknowledged with significant thankfulness.

ACKNOWLEDGMENTS

I would like to acknowledge Dr. Sullivan whose continuous guidance, encouragement, influence, and wisdom was critical not only with respect to this thesis, but also to the overall course map required for completion of my Master's in Science. He has been generous and flexible with his time and also created opportunity for me to carry out a methodological approach in the classroom that was the basis of this thesis. In that process he also created an experiential opportunity for me that could not have been achieved in any other way. For all of this I am very grateful.

I would also like to thank Dr. Hurtado and Dr. Standage for their willingness to participate with me in this effort and for the support and input that provided added value to this work.

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GLOSSARY OF TERMINOLOGY

1. Baseline Coursework – The developed single semester course centered around preconstruction tools and practices that serves as a basis for teaching and evaluation of content and its effectiveness for the student.
2. Bid Leveling – A process that is utilized to equalize the scope associated with bidding subcontractors. This includes ensuring that the subcontractor or vendor has both included all of the scope required for that particular bid package but not more that the required scope. The final result will be that the final bid prices include equivalent scope.
3. Bid Package Planning – A process used to break down an overall project into scopes of work that subcontractors and vendors can bid on.
4. Capture Plan – The capture plan is a strategic map that identifies key elements of a pursuit that serves to establish an organized effort on the part of the general contractor to maximize that general contractors' chances of being awarded the project. This will typically include communication strategies at multiple levels, site investigative strategies, team development for the project, and any number of other project unique focus areas.
5. Conditions of Satisfaction – Elements of the project which, in the end, are seen as critical components that contributed to a successful project in the view of each stakeholder.
6. Construction Documents – Used to describe a particular phase in design progression that reflects one hundred percent (100%) design completion. These documents will be utilized by the construction teams to construct the project.
7. Construction Manager at Risk (CMAR) – This project delivery method encourages collaboration during the design phase and construction portions of the construction project. The Owner retains both the Architect and Contractor; however, the Owner, Architect, and Contractor bear a responsibility to work together throughout the design phase to mitigate risk associated with constructability, schedule, cost, quality, and trade coordination. The form of contract for this particular delivery method typically results in the development of a guaranteed maximum/not to exceed price on the part of the general contractor.

8. Design-Bid-Build – A traditional delivery method in which the Owner retains the Architect to design the project after which time general contractors are solicited to bid on the project. In this method weight is generally given to the lowest qualified bid price for the work.
9. Design Development – Used to describe a particular phase in design progression that equates to approximately thirty percent (75%) of design completion.
10. Design Phase – This phase of a project, prior to project construction activities, during which time the project documents are being developed. This includes all required plans and specifications that will be required during the construction phase. Traditionally, this phase has included several design milestones such as Program/Concept, Schematic, Design Development, and Construction, each referring to a particular point in design progression. With the advent of alternative delivery methods, the design phase also provides an opportunity for the Owner, Architect, and Contractor to work together in a collaborative fashion for the benefit of the project. This phase can also be referred to as the Preconstruction Phase.
11. Estimating Software – The software platforms that are utilized for development of estimates. Some of the common platforms in use by major general contractors today include Sage (Timberline), WinEst, and RIB (MC2/ICE).
12. Front End Documents – Used to describe a document, produced by the general contractor as supplemental information utilized by bidding subcontractors and vendors. Generally, this supplemental information includes expectations for schedule adherence, unique project safety and quality requirements, and other general contractor unique requirements that the subcontractor or vendor will be held responsible for.
13. Go/No-Go Process – This refers to a process utilized by general contractors to study all of the characteristics of a prospective project and determine whether or not that particular project will be pursued. The end result of this process is a decision by the general contractor to either pursue or not pursue a particular project.

14. Guaranteed Maximum Price (GMP) - A guaranteed maximum price, also known as a not-to-exceed price, is used to describe an open book contract type in which the contractor is compensated for actual costs incurred plus a fixed fee subject to a not to exceed price.
15. Margin Plan – The margin plan is a tool utilized by general contractors to plan for financial outcomes of the project. This includes establishment of the negotiated base fee, anticipated enhancements to the base fee, and anticipated erosion to the base fee.
16. Milestone Estimating – Milestone estimates or cost models are those that are developed at each of the traditional design milestones such as schematic and design development phases. They are used to reflect the value of the project at each of the traditional design milestones.
17. Model Management – Describes processes used to utilize a 3-D modeling during the design to be used in multiple ways such as enhance visual opportunities and trade coordination.
18. Preconstruction – Used to describe activities undertaken during the Design Phase portion of the project. For purposes of this paper the term design phase and preconstruction will be used interchangeably.
19. Preconstruction Map – Chronologically illustrates major milestones and processes utilized during the Design Phase portion of the project.
20. Preconstruction Swim Lanes – Defines major Preconstruction Map activities that should be coordinated during the Design Phase portion of the project.
21. Programing/Preschematic – Describes a particular phase of design, one of the earliest phases, in which the project in its conceptual stages, is being defined.
22. Project Delivery – Describes the method by which a construction project is procured.
23. Project Delivery Method – Generally reflects the contractual arrangement (formal) by which a project is procured. The traditional method has generally been the Design-Bid-Build method; however, a shift has been occurring in the industry toward more collaborative methods such as Construction Manager at Risk (CMAR) and Design Build.
24. Project Identification – A process used by general contractors to identify projects that will be pursued. Generally, this includes identification of project characteristics that are attractive to the general contractor.

25. Pull Planning – Pull planning is a lean approach to scheduling in which together, all of the stakeholders of a project provide scheduling input in a collaborative fashion, starting with the end date to arrive at a date on which the activity must begin.
26. Quantity Survey Software – Software platforms used by general contractors to quantify elements of the project for incorporation into the estimate. The most common platforms in use today include On-Screen Takeoff (OST) and Bluebeam.
27. Schematic Phase – Used to describe a particular phase in design progression that equates to approximately thirty percent (30%) of design completion.
28. Virtual Design & Construction (VDC) – Used to describe the utilization of 3-D modeling to take advantage of the visual aspects of the design.
29. Scope Sheets – A tool used by general contractors to equalize the scope associated with bidding subcontractors and vendors. Other terms can include recap sheets or bid sheets.
30. Trending – Trending is used to describe a process in which cost implications of preconstruction decisions and/or anticipated decisions are tracked between milestone estimates. This term is also a component of a process supporting continuous cost modeling, a process that allows the preconstruction team/stakeholders to understand the total value of the project at any given point throughout the preconstruction or design phase process.
31. Value Analysis – Value analysis is a proactive process in which value opportunities are analyzed throughout the preconstruction phase to provide constructability input and systems analysis that will ultimately contribute to the benefit of the project. It is a proactive approach as opposed to a reactive one.

CHAPTER 1

INTRODUCTION

Overview

Change is inevitable. This has certainly been true in the construction industry, and most notably, in the way in which projects are delivered from a design phase or preconstruction standpoint. Approximately two decades ago the predominant delivery method, often referred to as the traditional method, was design-bid-build or lump sum hard bid. Within this method the owner would contract with a designer for the design of the construction project. Once the design was complete the project would go out to bid to any number of general contractors, who, along with their subcontractors and vendors, would submit a lump sum bid price, based solely on plans and specifications, on a prescribed date and time. Typically, within this method, the low responsive bidder would be awarded the work. Once the general contractor responsiveness was validated, the owner would issue a contract to the general contractor to perform the work. While this was considered a preferred method at the time, it lacked a collaborative approach between the owner, designer, and contractor that focused on alignment of scope and cost, value analysis opportunities, constructability review, general contractor input, coordination of systems, issues surrounding schedule, and overall quality outcomes impacted by the collaborative opportunity. With the increased utilization of alternative delivery methods such as design-build and construction -manager-at-risk (CMAR) models in recent years, the advantages of utilizing these methods continue to validate its use on all types of projects. Owner involvement during the process, quality of the project, level of communication, cost advantages, schedule advantages, and quality advantages are all viewed as characteristics of the alternative delivery models (Culp 2011). As predominant delivery methods continue to favor alternative approaches, it is important to recognize that the education and training of students who anticipate careers in the construction industry and related fields should be in lock step. Exposure to those tools and practices that are currently being utilized in alternative delivery processes, particularly with respect to general contractors, is an educational opportunity that should be taken advantage of.

Statement of the Problem

The challenge when considering such a preconstruction coursework that focuses on operative tools and practices today lies primarily in the lack of information that exists concerning how to teach it. There are certainly portions of preconstruction tools and practices that are taught in various construction programs that are valuable to the student. Estimating, for example, is a very tactical and common topic currently taught in most construction management and construction engineering programs of study. But understanding how estimating fits into the larger preconstruction context or map is beneficial to the student. Some of the questions that should be answered include:

- ✓ How often are estimates required? When are they performed?
- ✓ Who is involved in the estimating process?
- ✓ What should occur between estimates to control cost?
- ✓ What does an estimating package look like? What are the contents typically?
- ✓ What are the characteristics of a high quality estimate?
- ✓ How does general estimating and self-perform estimating differ?

Scheduling is another example of a topic that is commonly taught in programs of study today that that holds significant importance to the student. Understanding how alternative delivery methods have impacted scheduling processes in favor of more collaborative approaches is an important body of knowledge available to the student. For instance, what is the role of pull planning in scheduling and how is that different from a more traditional scheduling approach? These are questions that should be answered, particularly in today's environment in which alternative delivery methods are more predominant and require alternate approaches during the preconstruction phase.

The challenge or problem remains that there is no body of work that addresses how to teach preconstruction tools and practices that could serve to benefit todays student.

Research Objective

The objective embedded in this thesis was to develop a pedagogy for preconstruction tools and practices, teach the content, measure effectiveness, and establish a baseline for content associated with a coursework solution focused on the topic. An effective coursework will expose the student to dynamics associated with the current state of preconstruction processes today.

Research Methodology

The methodological approach included literature review, development of a curriculum map, creating teaching objectives for each of the topics, solicitation of industry feedback concerning included topics, creation of PowerPoint presentations to be used in a classroom setting, creation of a teaching opportunity, testing the coursework by teaching at the graduate student level (CON598 Preconstruction Tools & practices, Spring 2019), measuring the overall effectiveness of the coursework, and then assessment of the data to determine if the overall objective was attained. In the classroom setting data was collected in the form of non-open book quizzes, homework assignments centered around specific tools, and a final exam testing the overall retention level of the students centered around selected content. In addition, industry feedback was collected concerning the topical information that was developed along with input regarding additional topics that should be taught in such a coursework. The analysis of the data served to validate the overall approach and also influenced modifications that should be incorporated if the course is utilized in the future.

Inherent Limitations

As was stated in the introduction overview, the inherent limitation here is the absence of existing data that addresses how to teach preconstruction tools and practices as a single and coordinated coursework solution. The exhaustive literature review that was performed showed there was no previous research, particular to this topic, on which to rely upon that could help inform the thesis contents presented here.

Summary of Thesis

This thesis sets out to establish a baseline coursework to be used within construction management and construction engineering programs of study that can be used to communicate to the student operable tools and practices used in today's alternative delivery projects. Contents of the thesis include the following:

- Chapter 2 Literature Review – Presents literature review findings particular to how to teach preconstruction tools and practices, particularly in the collegiate environment.
- Chapter 3 – Methodology – Describes the methodological approach taken to arrive at a conclusion answering the question of how to teach preconstruction tools and practices. This includes literature research, arriving at baseline topics as a basis for a single semester course, developing teaching objectives associated with each topic, creating PowerPoints to be used for presentation of the data in the classroom, developing quizzes, developing homework assignments, developing a final examination, and then teaching the class at a graduate level as a way to draw conclusions supporting the original question.

Chapter 4 – Data Collection, Analysis, and Conclusions – This chapter summarizes the quiz, homework, and final examination results as a way to validate the methodology used for this thesis. In addition, summary level data will be presented regarding solicited feedback from the construction industry concerning the appropriateness of the selected topics and input regarding other topics that should be incorporated into the coursework.

CHAPTER 2

LITERATURE REVIEW

Introduction

Research on scholarly articles was conducted to discover any existing published works concerning, very specifically, the topic of how to teach preconstruction tools and practices. The following key words were used in the search:

Returning no results:

- ✓ Preconstruction classwork, preconstruction coursework, preconstruction curriculum, preconstruction syllabus, teaching preconstruction, curriculum, teaching design phase, teaching preconstruction, design phase services, preconstruction services

Literature Review Summary

While there is an abundance of literature available that speak to elements of preconstruction and design phase such as the advantages of alternative delivery methods, utilization of BIM in preconstruction, more effective subcontractor solicitation approaches, and the like, no existing work was found that addresses the question central to this thesis, and that is, how to teach preconstruction tools and practices. What follows then is an approach that serves to create a body of knowledge on this topic that can be reviewed, modified, and build upon in order to serve the needs of students, construction related employers, and the construction industry as a whole.

CHAPTER 3

METHODOLOGY

Introduction

As was stated in the previous chapter, there was no body of work discovered that answered the question concerning how to teach preconstruction tools and practices. The approach, therefore, was to develop a curriculum focused on preconstruction tools and practices, teach the coursework, measure student retention, gather feedback from students, and solicit industry professionals to provide input regarding content for such a curriculum.

Baseline Coursework Development

The initial effort included developing a curriculum map that contained relevant topics to be included in the coursework. Table 3.1 below summarizes the initial list of coursework topics.

TABLE 3.1
Expanded Topical List

Topic	Description	Topic	Description
1.00	Design Phase Changes Over Last 20 Years	24.00	Precon Phase Post-Mortem
2.00	Definition of Terms	25.00	Project Start-up
3.00	Successful Design Phase Services	26.00	Chart of Accounts
4.00	Behaviors During Design Phase	27.00	Early Cost Models
5.00	Project Identification	28.00	Program Estimate
6.00	Go No-Go Process	29.00	Estimating Precon Services
7.00	Capture Plan/Strategy	30.00	Milestone Estimating
8.00	Margin Plan/Deal Summary	31.00	Estimate Kick-off
9.00	External Team Kick-Off Meetings	32.00	Performing a Milestone
10.00	Internal Team Kick-Off Meetings	33.00	Designer Estimate Review
11.00	Establishing Project Goals	34.00	Owner Estimate Review
12.00	Organizational Structures – External	35.00	Self-Perform Conc Estimates
13.00	Organizational Structures – Internal	36.00	Trending/Continuous Estimating
14.00	Milestone Pull Planning	37.00	Innovation & Value Analysis
15.00	Phase Pull Planning	38.00	Estimating General Conditions
16.00	Daily Lean Management	39.00	Second Estimate Program
17.00	Precon Dashboards	40.00	Concrete Estimate Handoff
18.00	Risk Analysis/Risk Identification	41.00	Hard Bid Procedures
19.00	Risk Identification & Tracking	42.00	Capturing Historical Cost
20.00	Target Value Delivery	43.00	Teaming Agreements
21.00	Establish Weekly Workflow	44.00	Confidential Meetings
22.00	Tracking Action Items/Commitments	45.00	Choosing Design Partners
23.00	Precon to Construction Hand-Off Meetings	46.00	Contracting with Designers

Expanded Topical List (Cont.)

Topic	Description	Topic	Description
47.00	Designer Fees & Incentives	62.00	Design Assist Contracting
48.00	Design Deliverables	63.00	Subcontractor Prequalification
49.00	Design Schedules	64.00	Diversity/Inclusion Programs
50.00	Design Quality Control	65.00	Managing DB/DA Subcontractor
51.00	Bid Package Planning	66.00	Trade Partner Buyout/tracking
52.00	Design Issue Management	67.00	Bid Solicitation Process
53.00	Basis of Design	68.00	Scope Sheets/Recap Sheets
54.00	Design Reviews	69.00	Bid Leveling
55.00	Design Issues Transition to Cons	70.00	Authoring a GMP
56.00	Owner/Agency Design Review	71.00	Authoring Exhibit 1's
57.00	Not Used	72.00	Buy-Out Tracking
58.00	Managing Design Changes	73.00	BIM Execution Plan
59.00	Addressing Added Services	74.00	Estimating Software
60.00	Market Research	75.00	Quantity Survey Software
61.00	Front End Documents		

After the initial course mapping was completed, it was apparent that a condensing of the overall topic list would be required in order to make the teaching of the material appropriate for a single semester class. Table 3.2 below summarizes the topics ultimately chosen to be incorporated into the baseline coursework.

TABLE 3.2
Condensed Topical List

Topic	Description	Class Session
1.00	Design Phase Changes Over Last 20 Years	Week 1
2.00	Definition of Terms	Week 1
3.00	Definition of Successful Design Phase Services	Week 2
4.00	Behaviors During Design Phase	Week 2
5.00	Project Identification	Week 3
6.00	Go No-Go Process	Week 3
7.00	Capture Plan/Strategy	Week 3
8.00	Margin Plan/Deal Summary Intro	Week 3,4
11.00	Establishing Project Goals	w/Week 1
14.00	Milestone Pull Planning	Week 5
15.00	Phase Pull Planning	Week 6
30.00	Milestone Estimating	Weeks 7, 8
32.00	Performing a Milestone Estimate	Weeks 7, 8
36.00	Trending/Continuous Estimating	Weeks 9, 10
37.00	Innovation & Value Analysis	Weeks 9, 10
51.00	Bid Package Planning	Week 11

TABLE 3.2
Condensed Topical List (Cont.)

Topic	Description	Class Session
61.00	Front End Documents	w/Week 11
63.00	Subcontractor Prequalification	w/Week 11
64.00	Diversity/Inclusion Programs	w/Week 11
67.00	Bid Solicitation Process	w/Week 11
68.00	Scope Sheets/Recap Sheets	Week 12
69.00	Bid Leveling	Week 13
74.00	Estimating Software	w/Week 8
75.00	Quantity Survey Software	w/Week 8
	Class Material Review	Week 14

Once the topical list was condensed to accommodate a single semester schedule, objectives for each of the class sessions was formulated. The following represent a summary of teaching objectives that were developed for each week's overall topic.

Teaching Objectives

1.00 Design Phase Changes Over Last 20 Years — Week 1

- Define design phase
- Define predominant delivery methods - design-bid-build, construction manager at risk (CMAR), design-build
- Associate delivery methods with various contractual relationships
- Discuss the balance of delivery methods and how this has changed over the last 20 years.
- Discuss why the balance of delivery methods has changed

2.00 Definition of Terms — Week 1

- Define overall design phase swim lanes - overall process, estimating, design management, subcontractor/vendors, vdc/model management
- Define traditional design phase milestones - programing/pre-schematic, schematic, design development, construction documents, GMP
- Discuss key terms that will be a focus of our goal to "create" or "analyze" - margin plan/deal summary, pull planning, milestone estimating, trending, bid package planning, bid leveling
- Review overall process map - highlight particular areas of focus for this class.

3.00 Definition of Successful Design Phase Services — Week 2

- Define conditions of success - for the owner, general contractor, designers, subcontractors
- Discuss the characteristics of exceptional design phase services
- Discuss the behaviors necessary to deliver successful design phase services
- Discuss the obstacles that exist that are counterproductive to successful design phase services

Teaching Objectives

- Present two case studies - New Mexico State University Performing Arts Center & ASU BioDesign C
- Have class groups compare and contrast the two projects - discuss the good and the bad

4.00 Behaviors During Design Phase **Week 2**

- Associated behaviors are discussed as part of 3.00 in Week 2

5.00 Project Identification **Week 3**

- Discuss how projects are identified
- Define the components of a project that make it attractive to a general contractor
- Discuss the essential elements that need to be put into place prior to a Request for Proposal (RFP) being issued by the owner.

6.00 Go No-Go Process **Week 3**

- Define go/no-go
- Discuss the key elements that contribute to a go/no go decision

7.00 Capture Plan/Strategy **Week 3**

- Define capture plan/strategy. Why is this important?
- What are the essential elements of a good capture plan?
- Review an example of a capture plan with the class.

8.00 Margin Plan/Deal Summary Intro **Week 3, 4**

- Describe margin plan/deal summary. What is the margin plan used for?
- Describe main components:
  - Deal summary
  - Risks/opportunity summary
  - Pre-mortem
- Define detailed components:
  - Labor risk coverage
  - Supervision factors
  - Schedule
  - Proposed staffing
  - Define risks/opportunity summary
  - Base fee
  - Fee enhancement
  - Overall fee
  - Define pre-mortem
- Provide example to class of completed "acceptable" margin plan/deal summary.
- Produce a margin plan/deal summary together as a class.
- Distribute information associated with a sample project.
- Have class teams develop a margin plan on their own.
- Have teams present margin plans/deal summaries to the class and discuss.

11.00 Establishing Project Goals **w/Week 1**

14.00 Milestone Pull Planning **Week 5**

- Describe milestone pull planning. Why is milestone pull planning so important?
- Identify who the main "players" are in a project pull plan.
- List "main player" responsibilities during the design phase of a project.
- Provide an example of a milestone pull plan on a selected project.

Teaching Objectives

- Produce a "simple" milestone pull plan together as a class. Discuss the relationships of pull plan "players".
- Distribute sample project information.
- Have class teams develop a pull plan based upon the furnished criteria.
- Have class teams present pull plan results to the rest of the class. Discuss.

15.00 Phase Pull Planning **Week 6**

- Describe phase pull planning. How does it differ from a milestone pull plan and why is it important?
- Identify who the main "players" are in a phase pull plan.
- List "main player" responsibilities during the design phase of a project.
- Provide an example of a phase pull plan on a selected project.
- Produce a "simple" milestone pull plan together as a class. Discuss the relationships of pull plan "players".
- Distribute sample project information.
- Have class teams develop a pull plan based upon the furnished criteria.
- Have class teams present pull plan results to the rest of the class. Discuss.
- Briefly discuss weekly workflow as a more detailed view of the phase pull planning.

30.00 Milestone Estimating **Weeks 7, 8**

- Describe estimate milestones (review from pull planning session).
- Describe the components of an estimate/estimate package:
- Summary sheet
- Estimate detail
- Quantity survey supporting data
- Basis of estimate/estimate clarifications
- Other data (equipment rates, labor rates, general conditions, value alternatives)
- Review an example of a high-quality estimate package/discuss component parts.
- Review an example of a low-quality estimate package/discuss component parts
- Have class work in teams to review an estimate package provided to them. Have teams work in groups to generate comments. What is good? What is not so good? Discuss from various points of view (general contractor, designer, owner).

32.00 Performing a Milestone Estimate **Weeks 7, 8**

- Define milestone estimate.
- Define milestone estimate package components - summary, estimate detail, basis of estimate, general conditions, exhibits, value analysis/trend log
- Discuss the components that contribute to a high quality estimate.
- Discuss the components that contribute to a low quality estimate.
- Review with class an example of a high quality estimate.
- Review with class an example of a low quality estimate.

36.00 Trending/Continuous Estimating **Weeks 9, 10**

- Define trending.
- Discuss when trending is used.
- Discuss the benefits of utilizing a trend process during design phase.
- Review a trend log example with the class.
- Take the class through a process of comparing two simple drawings and identifying one or more trends.

Teaching Objectives

- Provide the class with two additional simple drawings.
- In teams, have the class generate trend items and share with the class.

37.00 Innovation & Value Analysis **Weeks 9, 10**

- Define innovation and value analysis.
- Discuss when value analysis is used.
- Discuss the benefits of utilizing a value analysis process during design phase.
- Review a value analysis log example with the class.
- Take the class through a process of reviewing a drawing to identify a value alternative opportunity.
- Provide the class with additional simple drawing.
- In teams, have the class generate a value alternative item and share with the class.

51.00 Bid Package Planning **Week 11**

- Define bid packaging plan.
- Discuss how a bid package plan is assembled. What is the foundation for a bid package plan?
- Discuss how bid packages are identified.
- Discuss multiple bid packaging. When is it used?
- Review an example of a bid package plan
- Work together to put a simple bid package plan together.
- Provide class with simple set of construction documents and the pull planning schedule worked out previously in class. Have teams work together to create a bid package plan to share with the class.

61.00 Front End Documents **w/Week 11**

63.00 Subcontractor Prequalification **w/Week 11**

64.00 Diversity/Inclusion Programs **w/Week 11**

67.00 Bid Solicitation Process **w/Week 11**

- Define bid solicitation.
- Discuss the types of platforms and methods are available for bid solicitation.
- Discuss the importance of bid solicitation records.
- Incorporating diversity goals into the bid solicitation process.

68.00 Scope Sheets/Recap Sheets **Week 12**

- Discuss Bid evaluation process.
- Define scope sheets/recap sheets.
- Discuss the importance of scope sheets.
- Define the major elements of a scope sheet.
- Review a scope sheet example.
- Demonstrate the filling out of a scope sheet with the class.
- Discuss subcontractor interview processes.

Teaching Objectives

69.00 Bid Leveling **Week 13**

- Provide the students with several subcontractor bids.
- Provide the students with a scope sheet template.
- Students are to develop a completed scope sheet on their own.
- Discuss results with class.

74.00 Estimating Software **w/Week 8**

- Provide a brief overview of WinEst software.
- Discuss the important elements of estimating software and demonstrate functionality.

75.00 Quantity Survey Software **w/Week 8**

- Define quantity survey.
- Discuss the various software platforms that are available to aid in quantity survey.
- Review OST software and functionality.
- Review Modelogix software and its functionality.

Class Material Review **Week 14**

Development of PowerPoint Presentations, Quizzes, Homework, Final Examination

Once the coursework topics and teaching objectives were established, other necessary coursework content was developed. Twelve PowerPoint sessions were created to serve as a basis for the class lecture covering the selected topics. An additional PowerPoint was developed and used as a review of overall course content that would likely be a part of the final examination. A series of in class administered quizzes were developed as well. There were two tools assignments that were developed, one covering the margin plan and capture plan, and the other demonstrating skills associate with bid leveling or analysis of subcontractor bids. A final examination was developed and administered through canvas online. The final examination was comprised of thirty multiple choice questions intending to cover the most important aspects of our class sessions together.

Development of Class Syllabus

Another important feature of the developed coursework was the syllabus that outlined course information, instructor information, overall program goals, program learning outcomes, course description, learning objectives, grading policies, other general policies pertaining to the class, university policies, and class schedule. The full text version of the syllabus is included as Exhibit A.

Methodology in Practice

The laboratory or crucible in which the methodology would be tested was, of course, the actual classroom. With the aid of Dr. Sullivan, a class session was opened up for the Spring 2019 semester. The class itself was advertised as a graduate level course that met on Monday evenings from 6:00pm – 8:45pm as noted below.

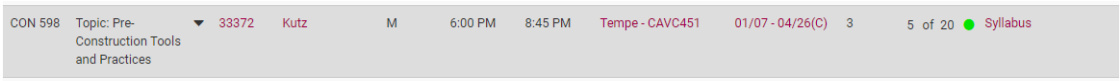


Figure 3.1
CON 598 Preconstruction Tools and Practices Course Advertisement

The class was initially limited to fifteen students but was expanded to accommodate twenty students. The class size eventually settled out at fifteen students. The first class session was conducted on Monday January 7, 2019 and culminated with a final exam conducted on May 14, 2019. During the semester data collection for the course would come in the form of multiple non-open book quizzes, homework assignments, and final exam. Ancillary information was also gathered in the form of a “plus/delta” session at approximately three quarters of the way through the course. This provided an opportunity for students to provide some candid feedback on both the coursework and the delivery of the material. Student comments will be considered in future revisions of the coursework.

CHAPTER 4

DATA COLLECTION, ANALYSIS, AND CONCLUSIONS

Introduction

As has already been stated data during the on-going teaching of the course was collected to measure student comprehension and effectiveness of teaching. This data came in the form of quizzes (non-open book), tools assignments, and final examination covering the complete semester. Additional data was solicited by industry professionals centered around the content of the course along with recommendations for additional content that should be taught as part of a course of this type

Student Quiz Results

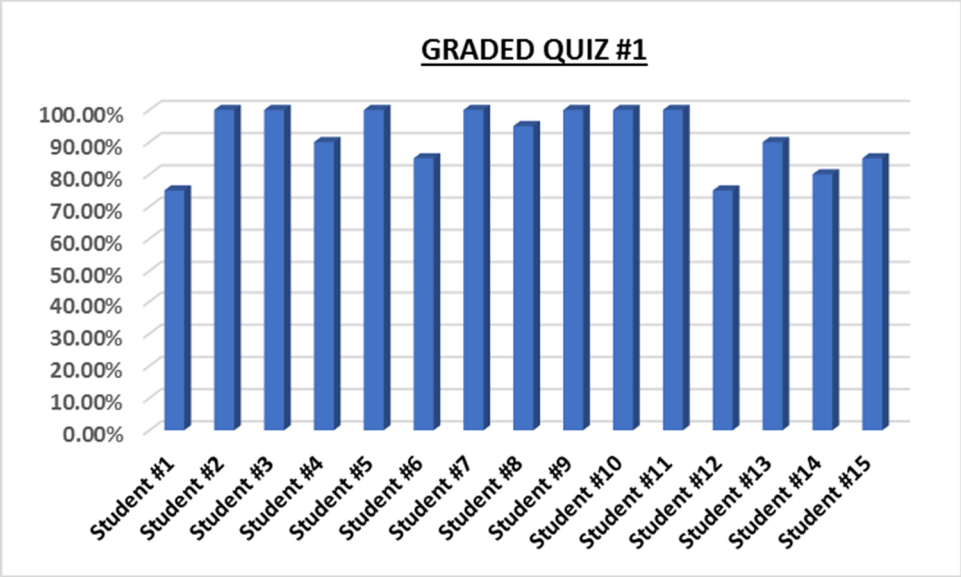
There were seven quizzes given during the course of the semester. Each quiz was administered during the beginning portion of the class and was in closed book style. The following pages present the results of each of the seven quizzes accompanied by a brief description of the associated content. It should be noted that Student #12 was not able to engage with the class due to travel schedules.

Quiz #1

Class Session Administered: Week 3

Covered Content: Weeks 1 & 2 PowerPoint presentation. Specific content included delivery method contract structure, traditional design phase milestones, conditions of satisfaction, main stakeholders during design phase, characteristics of exceptional design phase services, behaviors associated with exceptional design phase services, obstacles associated with exceptional design phase services.

GRAPH 1
Quiz #1 Results



Quiz 1 Metrics

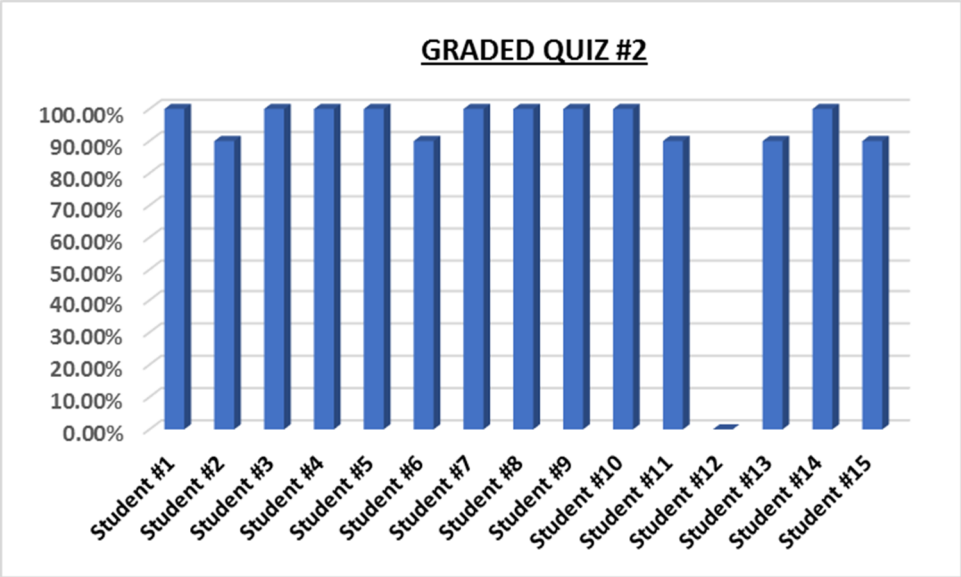
Average	88.73%	Maximum	100.00%
Median	90.48%	Minimum	71.43%
Standard Deviation	10.36%		

Quiz #2

Class Session Administered: Week 4

Covered Content: Week 3 PowerPoint presentation. Specific content included identification of milestone events relating to the overall preconstruction process map, project characteristics that influence a general contractor pursuing a project, Go No/Go decision making, margin plans/deal summary, defining pre-mortem process.

GRAPH 2
Quiz #2 Results



Quiz 2 Metrics

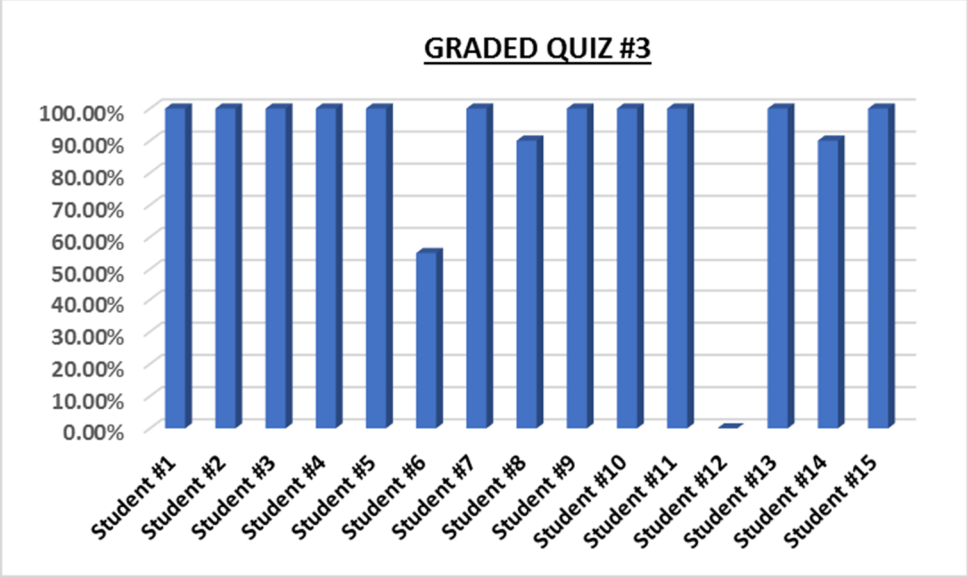
Average	96.43%	Maximum	100.00%
Median	100.00%	Minimum	90.00%
Standard Deviation	4.97%		

Quiz #3

Class Session Administered: Week 5

Covered Content: **Week 5** PowerPoint presentation. Specific content included pull planning process and differentiators from traditional CPM methods, milestone versus phase pull plans, traditional designer milestones, traditional general contractor milestones.

GRAPH 3
Quiz #3 Results



Quiz 3 Metrics

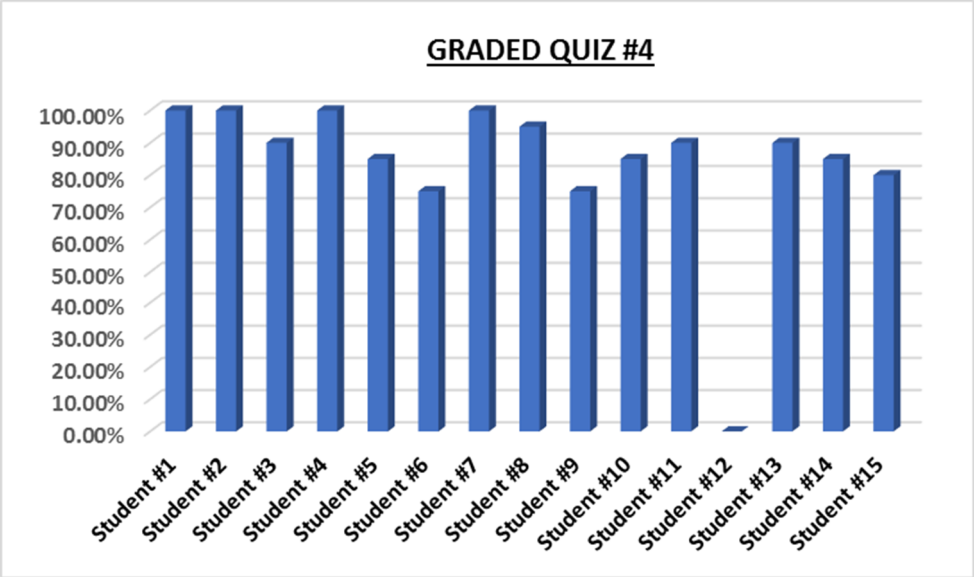
Average	95.36%	Maximum	100.00%
Median	100.00%	Minimum	55.00%
Standard Deviation	12.16%		

Quiz #4

Class Session Administered: Week 9

Covered Content: Week 8 PowerPoint presentation. Estimate basis, estimate summaries, estimate detail, estimate clarification, supporting quantity survey data, on-screen takeoff overview, ASSEMBLE software overview.

GRAPH 4
Quiz #4 Results



Quiz 4 Metrics

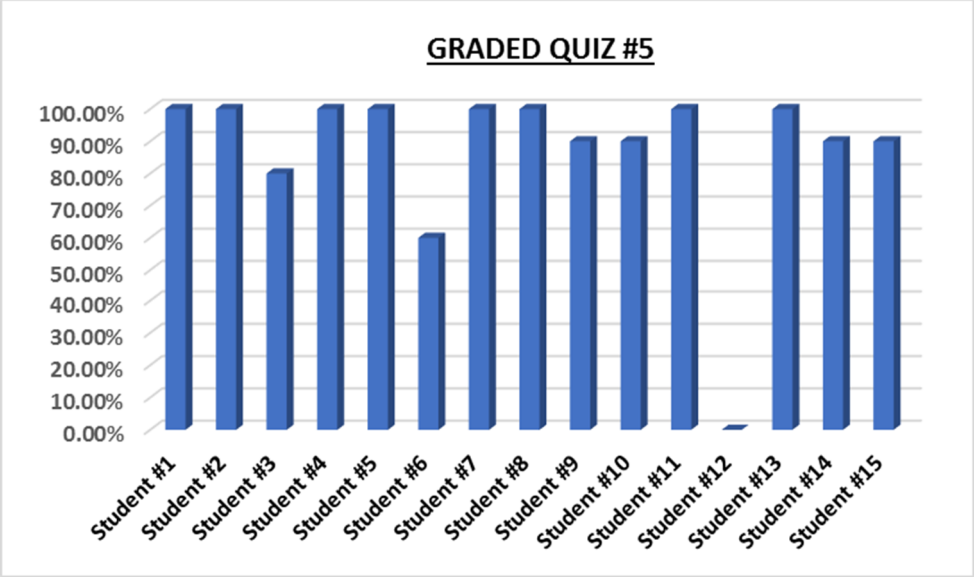
Average	87.86%	Maximum	100.00%
Median	87.50%	Minimum	75.00%
Standard Deviation	8.71%		

Quiz #5

Class Session Administered: Week 10

Covered Content: Week 9 PowerPoint presentation. Specific content included the use of trend logs and related benefits for its use, estimate ratification process, participants in a continuous cost modeling approach, trend log sources of information.

GRAPH 5
Quiz #5 Results



Quiz 5 Metrics

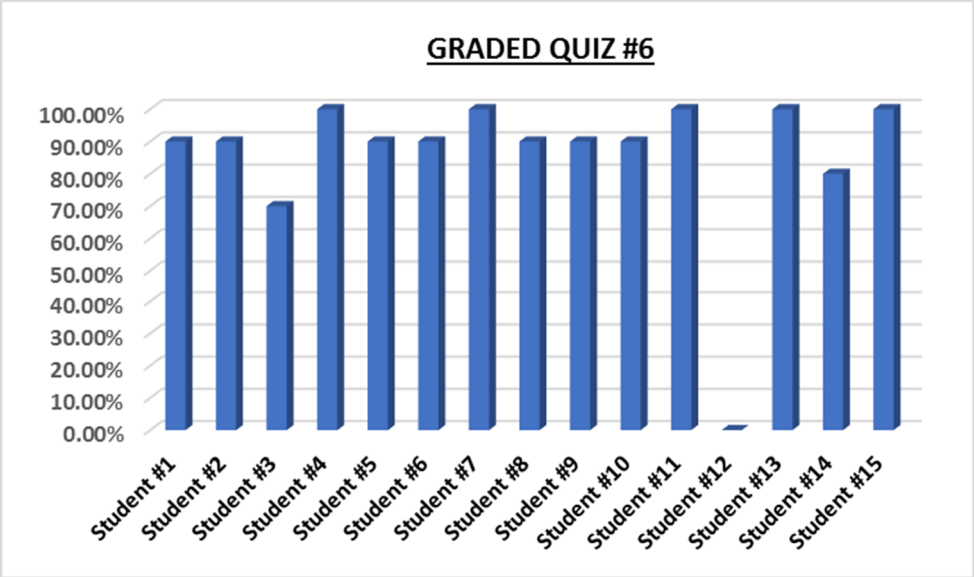
Average	92.86%	Maximum	100.00%
Median	100.00%	Minimum	60.00%
Standard Deviation	11.39%		

Quiz #6

Class Session Administered: Week 11

Covered Content: Week 10 PowerPoint presentation. Specific content includes value analysis process; it's importance, essential tools for implementation, participants, and participants skillsets.

GRAPH 6
Quiz #6 Results



Quiz 6 Metrics

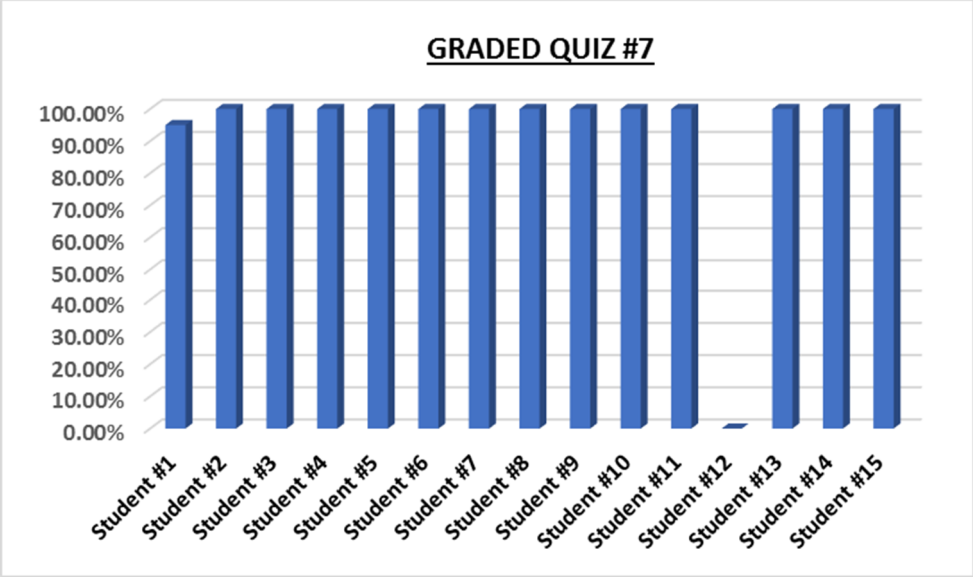
Average	91.43%	Maximum	100.00%
Median	90.00%	Minimum	70.00%
Standard Deviation	8.64%		

Quiz #7

Class Session Administered: Week 12

Covered Content: Week 11 PowerPoint presentation. Specific content includes subcontractor procurement, procurement methods with varying project delivery methods, procurement process, knowledge requirements when procuring subcontractors, defining front end documents and their relevance in the procurement process.

GRAPH 7
Quiz #7 Results



Quiz 7 Metrics

Average	99.64%	Maximum	100.00%
Median	100.00%	Minimum	95.00%
Standard Deviation	1.34%		

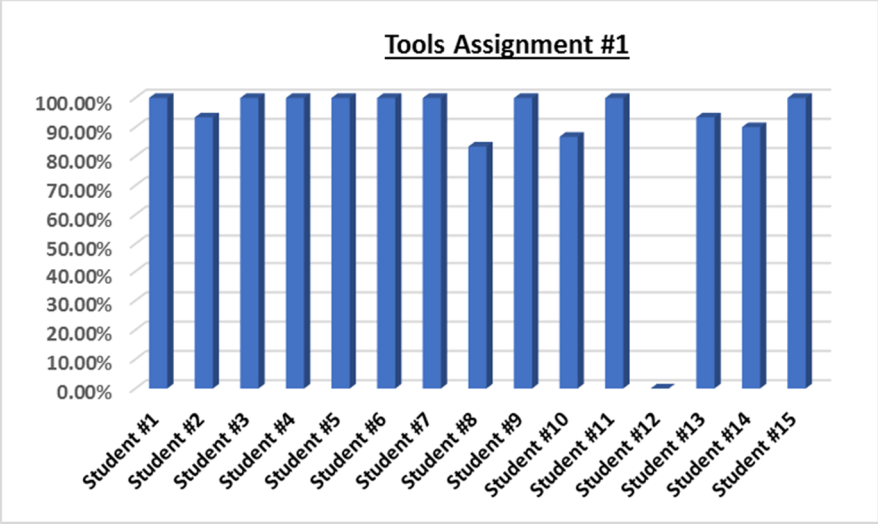
Tools Assignment 1 (Margin Plan) Results

Develop a Margin Plan/Deal Summary for a core and shell office building. Utilize the following as a basis for the plan:

- ✓ Building square footage: 280,000 Gsf, Budget: $56,000,000, Contract Type: CMAR, Base Fee: 4.25% - 4.75%, Schedule: 08/01/19 – 07/31/2019, Management Staff: Senior Project Manager (None), Project Manager (1 each), Assistant Project Manager (1 each), Superintendent (2 each), Assistant Superintendent (1 each), Project Engineers (2 each), Project Administration (1 each).

Assignment Objectives: Return an expected exit margin of between 4.75% - 5.00%, calculate fee per man month, calculate manhours per million dollars of value, calculate manhours per square foot, calculate square footage per month, and develop three pre-mortem Items associated with the project.

GRAPH 8
Tools Assignment #1 Margin Plan/Deal Summary Results



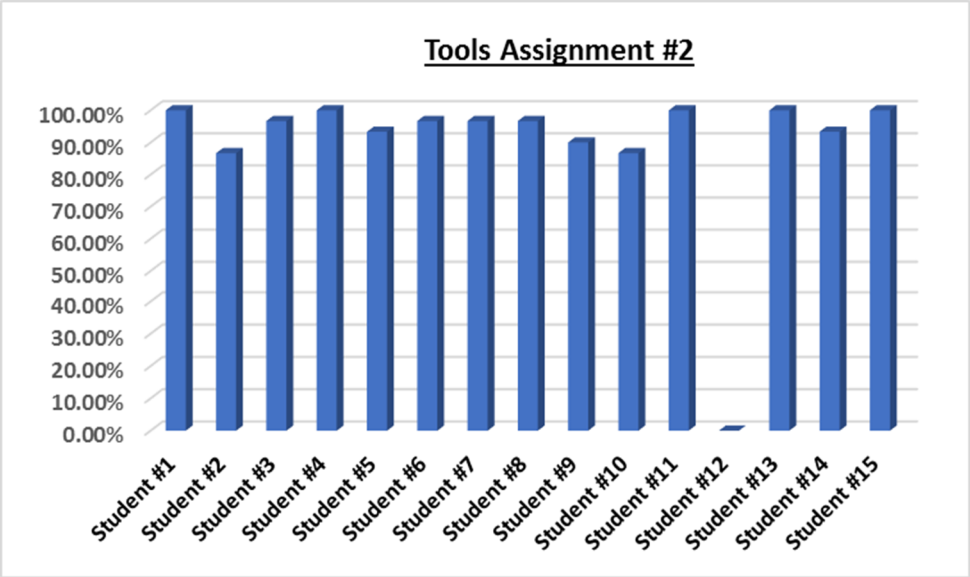
	Average	Median	Standard Deviation	Maximum	Minimum
Tools Assignment #1 Metrics	96.44%	100.00%	5.70%	100.00%	83.33%

Tools Assignment 2 (Bid Leveling) Results

Using the provided scope sheet template, analyze and tabulate subcontractor bid proposals from Sheets Drywall and JD Drywall.

- ✓ Attachments: Sheets Drywall Bid Proposal in .PDF Format, JD Drywall Bid Proposal in .PDF Format, Subcontractor Scope Sheet Template in Excel Format

GRAPH 9
Tools Assignment #2 Bid Leveling Results

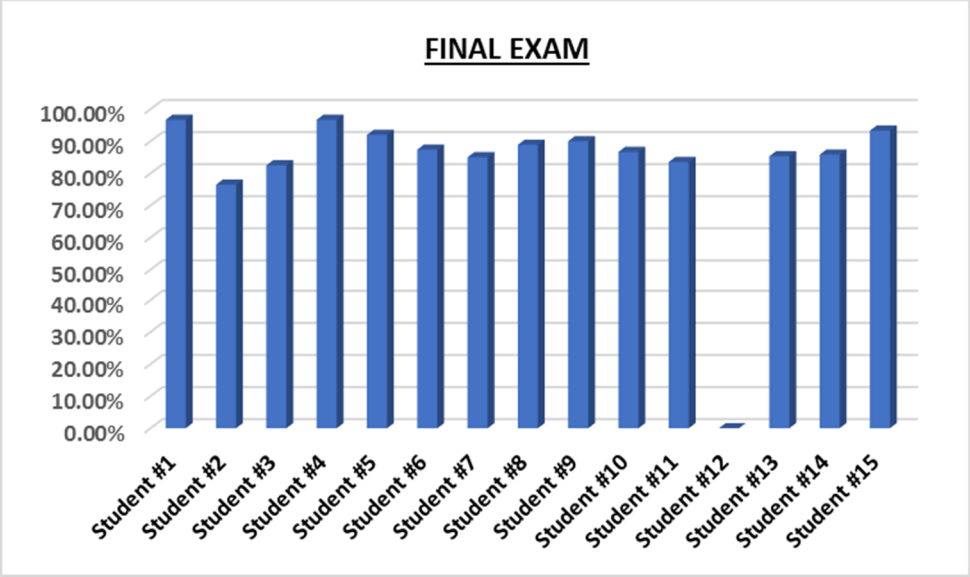


	Average	Median	Standard Deviation	Maximum	Minimum
Tools Assignment #2 Metrics	95.78%	96.67%	4.79%	100.00%	86.67%

Final Examination Results

A final examination was administered at the end of the semester comprised of thirty multiple choice questions. The focus of the questions was to confirm student retention of the most important elements of the course presented throughout the semester. The following illustrate the graded examinations per student.

GRAPH 10
Final Examination Results



Final Examination Metrics

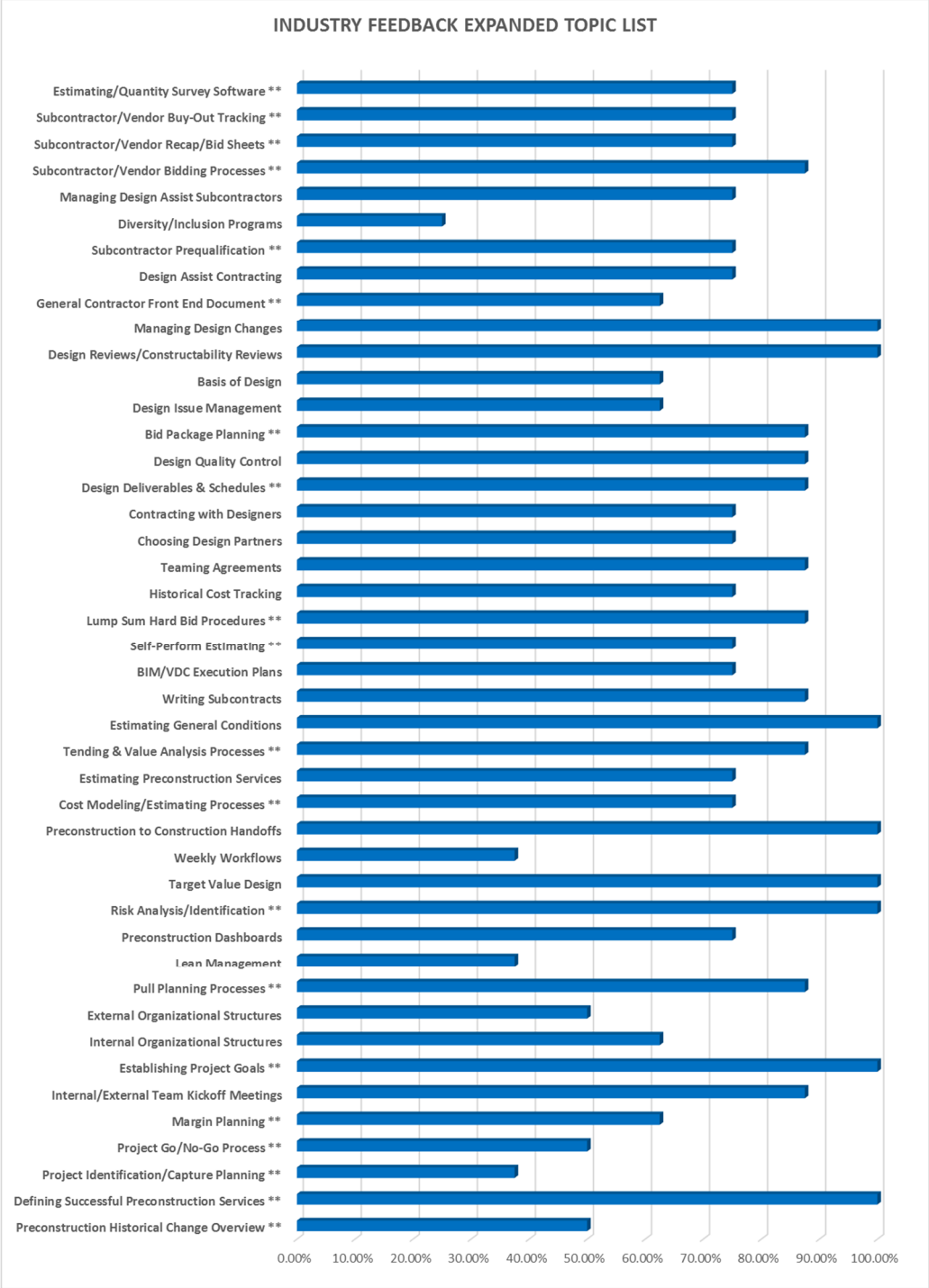
Average	87.87%
Median	87.03%
Standard Deviation	5.59%
Maximum	96.67%
Minimum	76.44%

Industry Feedback

An industry survey was developed and sent out to nine general contracting firm sources in the construction industry. The industry solicitation included nine industry professionals representing eight different general contracting firms. They included JE Dunn (1 respondent), Hunt (1 respondent), Mortenson (2 respondents), McCarthy (1 respondent), Big D (1 respondent), Haydon (1 respondent), Weitz (1 respondent), and Penta (1 respondent). The focus of the survey was to research consensus on both the expanded topic list and the condensed topic list that ultimately formed the basis for the Baseline Coursework. Sources were asked what they considered to be core competencies that should be taught from the list of topics. In addition, feedback was requested concerning additional topics that should be taught as part of a coursework that are not part of the list of topics. The graphs on the following pages summarize levels of consensus on a percentage basis for the expanded list of topics. The percentages represent levels of agreement amongst the respondents as to the importance of each topic with respect to inclusion in any preconstruction related coursework. For example, of the respondents surveyed, seventy-five percent of the respondents agreed that Estimating/Quantity Survey Software should be included in a coursework centered on preconstruction tools and practices. An additional graph was developed that included consensus on the condensed topical list only.

GRAPH 10

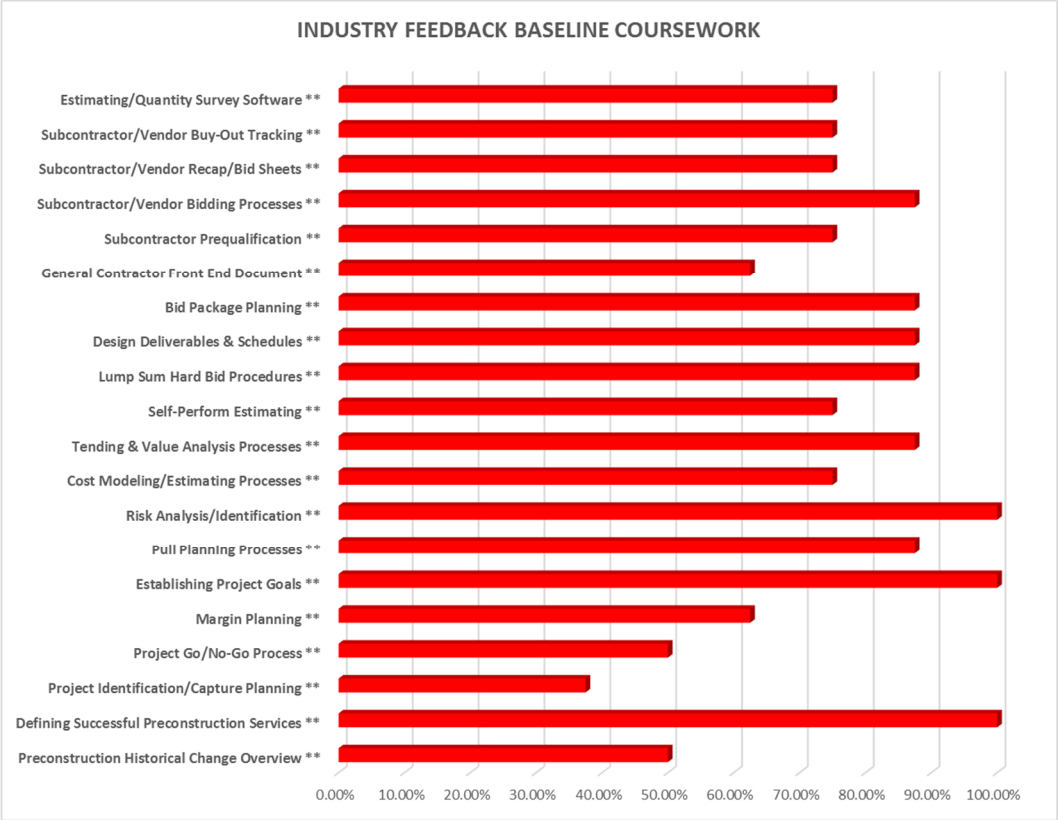
Industry Feedback – Expanded Topic List



*** Represents topics that are a part of the Baseline Coursework*

The following graph is a condensed version of the expanded graph that includes only those topics that are a part of the Baseline Coursework

GRAPH 11
Industry Feedback – Condensed Topic List (Baseline Coursework)



Instructor Evaluations and Student Feedback

Fifteen students enrolled in the class participated in the instructor evaluation process reflecting a 100% response rate for the survey. Ratings for Part 1, Part 2, and overall included 4.9, 4.97, and 4.8 respectively. In addition, there were several student comments that were noteworthy as follows:

"The subject matter of this course is extremely important. I really appreciated the emphasis that was placed on addressing process, the shift towards a longer pre-construction process and the shift towards IPD."

“Real world knowledge and teaching of the subject”

“I like all the practical knowledge and material demonstrated in this class. All the information from this class will definitely help me in my career.”

“The first two weeks seemed very basic for the CM majors, the CNE ones won’t have learned that information before (such as the delivery methods) so it's still important for the class to have that info, but maybe give an option for the CM majors to not have to sit for those classes because we are taught delivery methods in literally like 5 classes.”

“I wish the course was a little more developed and had different perspectives from a variety of general contractors. Sometimes seeing how different people approach the same tasks gives you a better idea of the challenges in general. A textbook would also be nice. Sometimes the topics feel rushed.”

“I'm sure coming up with a unified theory or general theory of pre-con is a massive undertaking however, as more emphasis is being places on pre-con it will be interesting to explore how experts break it down.”

“Lack of reading material makes it harder to gain a clear grasp at points. This is not the instructor’s fault as there is a famine of material on this subject.”

Data Analysis

It bears repeating here that with all of the content presented as part of the Baseline Coursework there was some knowledge on the part of the students regarding some of the topics that were covered in the course. Previously the research indicated that estimating and CPM scheduling are topics that are commonly taught as part of construction management programs as stand-alone courses. There were other topics and terms with which there was some familial knowledge, however, there was not a depth of knowledge that included the significance of how these tools and practices are used in the collaborative environments that alternative delivery methods provide. For instance, none of the students had ever experienced a pull planning session (related to scheduling) nor understood the benefits of such a process. There were other

tools and practices for which the students had limited knowledge such as margin plans and capture plans. Students were asked prior to teaching each session what the level of comprehension was for the particular topic that would be taught. In most cases there was only a superficial knowledge, and in some cases, no understanding of how the topic integrated within the overall preconstruction or design phase duration.

The quizzes were designed to cover the most important material for each of the relevant class sessions. As I previously stated, the quizzes were administered on a closed book basis as a way to truly assess the student's retention of the material. Overall, the class average, median, standard deviation, maximum, and minimum scores were 93.19%, 95.43%, 8.22%, 100.00%, and 73.78% respectively. On the surface one might argue that the students exhibited a high level of retention, however, the data could also suggest that the quiz material overall may have been too elementary for the students.

Tools Assignment #1 included the students working knowledge of a margin plan and tested student knowledge by utilizing the tool to return specific results given by the instructor. Overall, the class average, median, standard deviation, maximum, and minimum scores for this assignment were 96.44%, 100.00%, 5.70%, 100.00%, and 83.33% respectively. Again, the data suggests that the student working knowledge of the information was high, however, the data could also indicate that the information may not have been challenging enough for the student.

Tools Assignment #2 included testing the students bid leveling ability based on class instruction. Subcontractor bids were given to the students who were required to bid level or equalize those bids using a scope sheet/recap sheet provided by the instructor. Overall, the class average, median, standard deviation, maximum, and minimum scores for this assignment were 95.78%, 96.67%, 4.79%, 100.00%, and 86.67% respectively. The same comment as above applies here related to student retention and level of difficulty.

The final examination was administered in an online format and intended to test the student's overall knowledge of the topic taught during the semester. The instructor purposefully increased the difficulty level of the questions to test the students reasoning comprehension.

Overall, the class average, median, standard deviation, maximum, and minimum scores for the final exam were 87.87%, 87.03%, 5.59%, 96.97%, and 76.44% respectively.

In terms of the actual topics that were selected, 75.5% of the industry respondents agreed that the expanded list represented coursework material that should be taught as part of a curriculum. In terms of the actual coursework that was selected as part of the baseline coursework, 76.7% of the respondents agreed that the topics were relevant and should be taught to todays' students. In addition, the respondents identified additional topics that should be taught including managing the design build process, BIM data supporting preconstruction, contract terms and negotiation, MEP systems estimating, escalation, client feedback processes, integrated teams, owner cash flows, early conceptual estimating techniques, reading and interpreting soils reports, building code overview, energy code overview, technical writing, interpersonal communication, and building strong teams. The author acknowledges that many of these additional topics may already be taught as part of the existing program of study.

Data Analysis Conclusions

The objective here was to create a pedagogy for preconstruction tools and practices. A curriculum was developed with a parallel verification process conducted with industry professionals, content was delivered in a classroom setting for the first time, quizzes, tools assignments, and a final examination were administered but were likely found to not be challenging enough for the student.

Areas of improvement should be identified and incorporated into the pedagogy as a way to improve upon the foundation that has been set here. In addition, additional analysis should be continued through teaching repetition of the coursework. This will enable students to be better equipped as they anticipate careers in construction and related fields.

REFERENCES

Culp, G. 2011. “Alternative project delivery methods for water and wastewater projects: Do they save time and money.” Leadersh. Manage. Eng. 11 (3): 231–240

APPENDIX A

COURSE SYLLABUS

CON 598 Preconstruction Tools and Practices

Arizona State University | Del E. Webb
School of Construction Course Syllabus

COURSE INFORMATION

Semester: Spring 2019
Time/Location: Lecture: Monday 6:00pm – 8:45pm, CAVC 451
Website: Canvas (https://myasucourses.asu.edu)

INSTRUCTOR INFORMATION

Instructor: Barry T Kutz, Senior Vice President, McCarthy Building Companies, Inc.
Phone: (480) 449-4714
Email: Btkutz@asu.edu
Office Hours: Please email to schedule an appointment

Having graduated for the Arizona State University School of Construction in 1984, Barry has spent the last 35 years serving in various roles in the construction industry. For the last 15 years Barry has worked for McCarthy Building Companies Southwest Region in the Preconstruction Department and currently serves as Senior Vice President overseeing preconstruction activities for four regional offices. His project exposure includes K12, higher education, water/wastewater, renewable energy, healthcare, office buildings, parking structures, airport work, senior living, aquarium, and hospitality.

OVERALL PROGRAM GOALS

Construction management professionals combine knowledge of innovative technologies, construction principles and business management to lead a wide variety of construction projects from residential and commercial buildings to infrastructure projects. The DEWSC program goals are to teach students how to become responsible leaders in the construction industry through organization, leadership, and current/innovative management techniques.

The American Council for Construction Education (ACCE) states that it is essential that every Constructor be capable of effectively managing personnel, materials, equipment, costs, and time. The Constructor must be able to effectively communicate and understand their role as a member of a multi-disciplinary team, the assessment of project risk, and the alternate methods that can be used to structure the owner-designer-constructor team.

PROGRAM LEARNING OUTCOMES:

1. Lead individuals and teams in the delivery of projects in the built environment
2. Communicate effectively in verbal, written, and graphic forms to all participants in the built environment
3. Behave ethically, professionally, and sustainably in the construction industry and society
4. Effectively analyze, plan, and manage the components of the construction supply chain and manage the necessary human, material, equipment, time, and financial resources therein
5. Think critically and solve complex construction management problems

COURSE DESCRIPTION

There has been significant change in recent history in how construction projects are delivered. Of particular focus has been the dynamics and behaviors demonstrated during the design phase portion of the project. This course will analyze various tools and practices being utilized during this very important, and potentially impactful, period of time leading up to the actual construction of the project.

Prerequisites: Construction Engineering or Construction Management Graduate Student.

LEARNING OBJECTIVES

I want each student to gain an understanding of various preconstruction processes and tools that are utilized in today's environment. In addition, I want each student to have an understanding about how significantly design phase services have changed in recent history. Some of the areas of focus will include:

1. Describe design phase changes over the last twenty years.
2. Definition of common terms used during the design phase.
3. Analyzing components necessary for successful design phase services from the Owners, Designers, Contractors, and Subcontractors point of view.
4. Describing essential behaviors that are necessary in order to deliver high quality design phase services.
5. Understanding how construction projects are identified and how the Go/No-Go and Capture Plan/Strategy is crucial in the identification of these projects.
6. Understand the importance of and create a margin plan that meets the financial goals established for the project.
7. Understand the importance of pull plans. Create a pull plan for milestone and phase plans.
8. Understand the components that contribute to milestone estimates. Evaluate various milestone estimates and be able to comment on both quality and content.
9. Understand the importance of trend logs during design phase. Be able to evaluate a trend log for both quality and content.
10. Understand the importance of innovation and value analysis processes during design phase. Be able to evaluate an innovation/value analysis log for both quality and content.
11. Understand the importance of bid packaging and be able to create a bid package plan.
12. Understand the bid solicitation process.
13. Understand the importance of subcontractor and vendor recap/scope sheets and describe the various components.
14. Understand the bid leveling process and apply that knowledge in a bid leveling exercise.
15. Understand the components that contribute to authoring a Guaranteed Maximum Price (GMP) package.
16. Describe Exhibit 1's, their purpose, and discuss the various philosophies that are in play as Exhibit 1's are being authored.

TEXTBOOKS AND REFERENCE MATERIAL

There are no required textbooks or readings for this class.

GRADING POLICY

The following criteria, weights, and grading scale will be used to calculate the Final Grade (the Instructor may modify/adjust as necessary). The grade range below will not be curved and will be fixed for the semester.

Component	Weight
Class Attendance & Participation	20%
Quizzes	20%
Written Papers	20%
Tools Assignments	20%
Final Exam	20%

Grade	Range
A+	98-100%
A	92 – 97.9%
A-	90 – 91.9%
B+	88 – 89.9%
B	82 – 87.9%
B-	80 – 81.9%
C+	78 – 79.9%
C	70 – 77.9%
D	60 – 69.9%
E	0 – 59.9%

COURSE POLICIES, PROCEDURES, AND REQUIREMENTS

Classroom Procedures – The classroom represents your professional environment (or one of them) during your tenure at ASU. Thus, please act professionally in the classroom. Cell phones should not be used during class and laptops should only be used for note-taking and research as appropriate. The use of recording devices is not permitted unless approved by the Instructor. Address the instructors and your fellow students with respect. The instructors want you to be successful. Please utilize their contact information to get help if you need it.

General Policies – You must come to class prepared – that is, with pens, pencils, highlighters, note taking material. Please also come to class prepared to participate in discussion.

Attendance and Participation – Class attendance is mandatory for all Lectures. You are allowed one excused absence. This includes absences for work, family, or other occasions. For over one absence, 5% will be deducted from your overall grade at the end of the semester, and an additional 5% will be taken for each additional absence thereafter. Medical absences are excused if a doctor's note is provided. Medical absences do not count against your one absence.

Quizzes – Quizzes may be given throughout the semester to check students' competency and preparedness. Quizzes will generally be administered at the beginning of each class session on previous weeks lecture. There will be no makeup quizzes.

Make-Up Policy – Prior notice (at least 48hrs in advance) must be given to the instructor when a class will be missed. It is the student's responsibility to obtain notes, supplemental material, and assignments from fellow classmates. Only under the most extreme circumstances, supported by written documentation, will a make-up exam be given. The final decision rests with the instructor.

Assignments – There will be approximately 5-10 assignments throughout the semester. Assignments will be due at 11:59PM on the date specified by the instructor. All assignments shall be submitted through Canvas unless otherwise specified. Late submissions will be accepted till the end of the semester with a 75% grade deduction. Messy work or solutions will not be graded.

Notebook – A notebook is optional, but you are strongly encouraged to keep a comprehensive, professional notebook/binder covering the entire course to include lecture notes, homework, quizzes, exams, projects, and guest speakers. It must be in a 3-ring binder and include a cover sheet, table of contents, and appropriate tabs separating the categories or in a well-organized digital format. Your effort will be measured at the end of the semester and will allow you the possibility to improve your final grade by three percentage points (3%).

Final Examination – A Final Exam will be administered at the end of the semester to test the student's knowledge of course information. No make-ups will be offered for exams.

UNIVERSITY POLICIES

Academic Integrity - All students in this class are subject to ASU's Academic Integrity Policy (http://provost.asu.edu/academicintegrity) and shall acquaint themselves with its content and requirements, including a strict prohibition against plagiarism. By registration in this class, you are assumed to have read, understand and agreed to this policy. All violations will be reported to the Dean's office, who maintains records of all offenses.

Student Code of Conduct - The Student Code of Conduct sets forth the standards of conduct expected of students who choose to join the university community. Students who violate these standards will be subject to disciplinary sanctions (http://students.asu.edu/srr/code).

Classroom Behavior - Any violent or threatening conduct by an ASU student in this class will be reported to the ASU Police Department and the Office of the Dean of Students. The use of recording devices is not permitted during class (unless permitted by the Instructor).

Religious Observances - Accommodations will be made for religious observances provided that students notify the instructor at the beginning of the semester concerning those dates. Alternative arrangements will generally be made for any examinations and other graded in-class work affected by such absences.

University Sanctioned Activities - Students who expect to miss class due to officially university-sanctioned activities should inform the instructor early in the semester. Alternative arrangements will generally be made for any examinations and other graded in-class work affected by such absences.

Disability Accommodations - Suitable accommodations will be made for students having disabilities and students should notify the instructor as early as possible if they will be required. Such students must be registered with the Disability Resource Center and provide documentation to that effect.

Academic Calendar - The academic calendar (https://students.asu.edu/academic-calendar) contains important dates that students should be aware of, including: the first and last day of class, drop/add deadlines, withdrawal deadlines, and observed holidays.

Copyright Protection - All contents of these lectures, including written materials distributed to the class, are under copyright protection. Notes based on these materials may not be sold or commercialized without the express permission of the instructor.

Syllabus Changes - Any information in this syllabus may be subject to change with reasonable advance notice.

Title IX - Federal law which provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at https://sexualviolenceprevention.asu.edu/faqs.

As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, https://eoss.asu.edu/counseling, is available if you wish to discuss any concerns confidentially and privately.

CLASS SCHEDULE

The instructor reserves the right to modify and/or adjust the schedule. A full schedule will not be distributed, but a two week look ahead will be released on a bi-weekly basis through Blackboard, and students will be notified of any changes.

University dates are listed below:

Classes begin	January 7, 2019
Last day to add/drop without approval	January 13, 2019
Martin Luther King Jr. Holiday	January 21, 2019
Spring break	March 3 – 10, 2019
Course withdrawal deadline	March 31, 2019
Last day of classes	April 26, 2019
Final exams week	April 29 – May 4, 2019