

A Comparison between Mini-mester and Full Semester Achievement in a Construction Surveying Course

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The goal of this study was to explore the differences in academic performance between students who took the traditional 15 week fall and spring semester courses and students that took the compressed 10 day May mini-mester course of construction surveying. There were no instructional design differences between semester with respect to instruction, materials, activities, applications, or exams. This study found that students taking the mini-mester course had significantly better achievement on the laboratory activities, the readings quizzes, and total course grade points than that of the students taking the traditional semester courses. However, the students taking the traditional semester courses significantly exhibit better achievement on the two course exams than did the students taking the mini-mester course.

Key Words: Construction Education Research, Construction Surveying, Reasoning Ability, Semester Compression, Achievement

Introduction

The academic timeline for a full semester has long been established as having courses taught within 14 to 16 weeks both fall and spring. However, university administrators continue to push for a reduction in the time from when a freshman student begins their degree program to when they graduate. For the degree program of this current study, the time period is close to 4.2 years for a four year degree. At the present time this 1,065 undergraduate construction science program teaches a full course load during the summer semesters. This summer offering includes a ten-day May mini-mester, a five week summer one semester, a 10 week summer semester, a five week summer two semester, and a ten day August mini-mester, together they provide students with a full slate of course offerings. All of these are examples of compressed course offerings. In addition to these examples, there is also course compression occurring during the full semesters. This is done by offering two eight-week courses, back to back, during the sixteen-week full semester as a transfer student accommodation. The current investigative study was designed to examine the following research question: What is the difference in academic performance between students who took the full semester courses and students that took the compressed mini-mester course of construction surveying. The results of this study should assist an instructor in identifying and understanding the distinctive needs of students with respect to differing semester timelines and student academic achievement.

Although a compressed course includes the same number of contact hours with students, they are designed to cover the same amount of information as that within a full semester course, in a fraction of the time. Cognitive research has found that when learning and practice periods are not compressed but are spaced out over a longer period of time, long term memory is improved (Carrington, 2010). This would suggest that learning would be enhanced by teaching a course in regular increments spread out over a longer time period. There is much research in educational psychology that investigates the effects of intensive and compressed courses (Daniel, 2000; Scott, 1996; Seamon, 2004; Scott & Conrad, 1991). Most researchers measure short term learning by evaluating quiz scores and long term learning with mid-term and final exams. Many of these educational psychology studies have found results that are inconsistent with the long spacing effect found by the cognitive researchers.

A real concern is that instructors may ease academic rigor due to the compressed summer course schedule. A study by Allen et al. (1982), found several factors that were significantly less characteristic of compressed semester courses than of full semester courses. These factors included: use of standard text, lectures, term papers, and tests and quizzes. Their study also reported that compressed courses tended to have a smaller variety of grading assignments and that they covering less material than a full semester course. It would seem therefore, instructors of compressed courses might be lowering or changing course standards, which could affect an increase in student achievement. In an extensive literature review and meta-analysis prepared by Daniel (2000), the findings indicated that across several disciplines both long-term and short-term learning and achievement are equal when comparing compressed and full semester courses. Scott & Conrad (1991) reviewed research on multiple formats of course offerings and concluded that student learning in compressed courses was equal to or exceeded that of full semester courses. Kuzmar (2013) compared mini-session to normal-length session courses and found that the mini-mester students had a slight but not significant advantage in achievement over regular semester students on final grades. Kuzmar's study was a qualitative and not quantitate study, this study provided no support for his findings and assertions.

Scott (1996) found that students prefer intensive and shortened courses to regular semester courses and that both semester formats yielded the same academic performance. Specifically, students reported that summer courses encouraged more focused learning, created a more collegial atmosphere, and fostered more classroom student interactions and discussions than regular semester courses. Austin & Gustafson (2006) investigated term lengths using a database of over 45,000 observations using the final grade received in the course. In their work, they were able to control for many of the confounding or missing demographic variables found in previous works, i.e. race, gender, SAT, ACT, age, high school GPA, etc. They found that compressed courses do result in higher grades than that of full semester courses and were able to show that the higher grades were a reflection of increased knowledge and not of instructors *lowering the bar* during compressed semesters. Again, a study by Caskey (1994) found no statistical difference between scheduling formats in accounting courses. Petrowsky (1996) found that students in compressed courses did better than students in traditional courses on the first-half test of the course, which involved simple recall of information. On the other hand, their performance was worse on the second-half test of the course, which involved comprehension, application, and analysis.

What impact does compressed semesters have on the learning and academic success of construction students? A better understanding of these relationships may influence how instructors design and teach their courses. Thus, this study addresses three weaknesses in the literature. First, only one study was found to specifically address compression within construction courses. Second, no studies were found that explicitly addresses a laboratory course and compression. Third, many existing studies were poorly controlled, in that; they failed to account for changes in teaching methods between compressed and full semester courses.

Methodology

Instructional Design

The construction surveying laboratory course is an online web-based offering of instructional materials, video textbook, illustration videos, field data reporting and application assignments. The instructor and teaching assistants provide direct laboratory tutoring and assistance. Recitation sessions are held to establish survey crew membership, provide for five quizzes over their assigned video viewings and for two exam periods. Recitations are immediately prior to each of the field activities. Laboratories consist of continuous four-hour field activities that may be conducted any day and time of the week, which is at the discretion of the crew membership. The surveying concepts

include vertical, horizontal, slope and angular measurements. These measurements were practiced using open and closed circuits, traversing, as-built, and pier location surveys. Nine four-hour laboratory activities were conducted which required field data measurements, booking calculations, and application of field survey results. These applications include paper-and-pencil sketches as illustrations, AutoCAD drawings validating measures of circuits and traverses, and Excel spreadsheets with topography surface and line charts. Laboratory assignments are made immediately after recitation and are due 30 minutes prior to the following week's recitation. Students are provided swipe-card access to the surveying equipment room. They have access to their equipment all hours of the weekday and the weekend. The 30 crew equipment lockers each contain $9,200 of surveying equipment and include, tapes, pull scale, marking pins, string line, string level, plumb-bob, gammon reel, sledge hammer, tripod, tripod stabilizer, bipod, grade rod, prism and prism pole, auto level, theodolite, and total station. The course was designed for 30 three-member crews, but currently the course is serving 120 students per semester, so crew membership is at four per crew. The instructor's office is immediately adjacent to the equipment room and the teaching assistants have a desk within the equipment room. This arrangement provides students speedy access to either the instructor or the teaching assistants if they have questions or equipment issues that need to be resolved.

The full semester fall and spring course format is predicated upon a 15-week semester where students are enrolled in additional courses. In most instances, they are enrolled in 12 to 16 credit hours or a full semester load. The first week is reserved for establishing the crew membership and equipment inventory and checkout. The students establish the survey crews of four students. Laboratories 1 through 5 are delivered in weeks two through week six. Laboratories 2 through 5 may be reworked in week seven, which is the mid-term exam week. No other laboratories may be reworked. Scoring of a reworked laboratory is calculated using the average of the original score plus two of the new scores. Weeks 8 and 9 provides laboratories 6 and 7. For laboratory 8, the class is divided into two groups, one group works the laboratory week 10 and the second group works the laboratory in week 11. Week 12 is for laboratory 9. The 13th week is either spring break in the spring or thanksgiving holiday in the fall. Week 14 is when the second exam is given. The surveying course ends one week prior to all other departmental courses because the university does not have a testing time for web-based courses. Week 15 is reserved for equipment inventory and check-in and in the case that there has been a rain delay it will be used to finish the remaining laboratory activities (*See Appendix A*).

The compressed May mini-mester is a 10 day summer semester format. The undergraduate academic advisors do not allow students in the mini-mester to be employed or be enrolled in any additional courses during the class. Once a day in either the morning or evening there is a one-hour recitation session in addition to the eight hours of fieldwork. Each day is equal to two weeks. However, in that, this course is in the spring and in May rain is always a threat to laboratory completion. As a general observation, one to two days will be lost to rain. Optimally week one will include; day one course setup and laboratory 1. Day 2 is laboratories 1 and 3 and day three is for laboratories 4 and 5. Day 4 is reserved for reworking laboratories 2 through 5. Day 5 is a rain makeup day. Week 2 will begin with the first exam in the morning and laboratory 6 in the afternoon of the day six. Day 7 will include laboratories 7 and 8. Day 8 continues and finishes laboratory 8. On day 9 laboratory 9 will be conducted and the afternoon is reserved as a rain makeup day. Day 10 is reserved for study and the second exam laboratory (*See Appendix B*).

Between these two instructional strategies, there is no change in instructional materials, video viewings, laboratories, application/extension, quizzes, or exams. Laboratories are scored from values within a database and represent the difference from those values and the data the crew enters into the online laboratory data form. All field books and applications of the data are scanned and submitted as PDF documents. These are graded in accordance with the posted rubric on the activities page of the course web site. Three iterations of each quiz are made so that students do not have an identical quiz being taken next to them. Each quiz has between five and ten questions that require information recall. Exams are twenty-five questions in length and require information recall, mathematics,

problem solving and application. Question types included multiple choice, matching, short answer, fill-in-the-blank, booking, and calculations.

Student Achievement

Construction surveying achievement was measured as scores on (a) nine laboratory activities, (b) four quizzes covering course readings, (c) two non-comprehensive exams, and (d) final points earned. Laboratories consist of continuous four-hour field activities and are worth 630 grade points out of 1,000 total course points. The laboratory scores had an estimated reliability based on Cronbach's Alpha of $\alpha = .64$. Quizzes 2, 3, 4, and 6 were each content related, and included questions covering the required readings. These quizzes were worth 80 grade points. Credit for Quiz 1 was given to students for taking the TOLT, credit for Quiz 5 was given to students for participation in an additional research study, and Quiz 7 credit was given for attendance. The last three mentioned quizzes are excluded from this analysis; in that, they did not cover course content. There was a one-hour mid-term exam and a one-hour final exam given; each exam was worth 135 grade points. These exams included multiple choice, matching, fill-in-the-blank, calculations, and application questions. Each of these three course achievement indicators constituted the final course points and represents the remaining dependent variables of this analysis.

Reasoning Ability

The Test of Logical Thinking (TOLT; Tobin & Capie, 1981) measures five modes of formal reasoning ability. The TOLT measures the dimension of *formal thought* and has a high test reliability (Cronbach's Alpha of $\alpha = .85$). Cronbach's (alpha) is a statistic that estimates the expected reliability and internal consistency of a psychometric test. It measures whether the items that are propose to be measured are the same construct and that it produced similar item scores. The participants that answered correctly should have an overall higher score than those participants who answered it incorrectly. The test consists of 10 questions. Two multiple-choice items represent each of the first four reasoning modes: proportional reasoning, probabilistic reasoning, controlling variables, and correlational reasoning. For the first eight questions, students were asked to choose the correct answer along with their justification for selecting that answer. Both answer and reasons must be accurate to get the question correct. The last two questions are comprised of combinatorial reasoning and required students to list, without any replication, all possible combinations of a solution set. Possible scores for the TOLT are between 0 and 10. For each correct answer and reason, students will receive 1 point and for every wrong answer or incorrect reason, students will receive 0 points. While the average time for the TOLT, from our previous online administrations, was 25 minutes, time was not constrained in the current study. In the current sample, the test had an estimated reliability based on Cronbach's Alpha of $\alpha = .56$. The TOLT score served as a dependent variable in the data analysis. Prior to beginning the TOLT, students completed a short survey to obtain demographic data based upon self-reported variables (e.g. gender, age, grade level, etc.).

Participants

Three construction surveying courses taught in summer 2015 ($N = 81$), fall 2015 ($N = 104$), and spring 2016 ($N = 78$) by the same instructor at a large, south-central university in the United States participated by completing a cognitive ability test ($N = 263$) in exchange for 20 quiz points. The instructor included seven quizzes throughout the semester and dropped two of each student's lowest quiz grades; therefore, students who did not participate in the study had no adverse consequences. Of the initial 263 students, fourteen students were excluded due to either not finishing the course and/or not taking the TOLT. Additionally, seven students were excluded as outliers. An outlier for this study was identified when a student's TOLT duration was particularly shorter or longer than what might be expected based on two standard deviations from the population mean ($M = 20.94$, $SD = 7.34$). After these few exclusions, the population size was reduced to 242 students. For this current analysis, the final count of students in

the compressed May mini-mester was 76. Therefore, for this analysis 76 students were randomly chosen from the two full semesters, spring and fall. This reduction of half from each full semester will allow the analysis of data to be fit to equal cell size statistics. The final sample data set included 152 students from the original data set.

To determine if there were differences between the May mini-mester, the spring and fall full semesters, a one-way analysis of variance (ANOVA) was conducted using the TOLT scores. An ANOVA is a statistic used to analyze the differences among and between group means. It determines if there are any significant differences between group means; the *p* value. No significant differences were found in the students' reasoning ability between the three semesters, indicating that the three groups could be pooled into a single sampling set for this analysis (M = 7.11., *SD* = 2.40, $p = 0.69$) and that they could be considered to be at the same level of cognitive reasoning ability. The participants consisted of 13 female and 139 male students with ages ranging from 19.82 to 28.97 years ($M = 22.20$, $SD = 1.50$). This course typically has a heavy male population due to their enrollment in a degree program that generally attracts more males at the institution. Most students were upper-level undergraduates and the course is to be taken in the first semester of the junior year. From the sample, three students were sophomores, 30 were juniors, and 119 were seniors. An observation from these characteristics reveals that students tend to delay taking the course until their final year.

Procedure

The TOLT, a reasoning ability test, was utilized for combining the differing semester groups in this study. The test was administered online in an unproctored environment. The TOLT was assigned on the second recitation period of the semester and was to be completed outside of laboratory time within five school days. Students gave permission to use their background information, TOLT score, and course achievement scores. Only data collected from consenting students were included in the study. This study met the Institutional Review Board requirements of this university. All data utilized in this analysis will be made available from the author upon receipt of a written request.

Results

The first investigation was into how well correlated were these assessment measures. A bivariate correlation is a statistical measure used to indicate the extent of mutual fluctuation between variables or simply put a measurement of the strength of the relationship between the two variables. This measure can range from absolute value 1 to 0; the stronger the relationship, the closer the value is to 1. For example, what is the probability that an increase in the TOLT score will respond to an increase in exam points or laboratory points to quiz points. The data was analyzed for bivariate correlations between the cognitive ability measures and achievement measures (see Table 1). It was expected that there would be substantial overlap in variance, and thus positive correlations between each of the achievement variables. Because of the large sample size, all observed correlations were statistically reliable, so the magnitude of the relationships is of particular interest. As one would expect, there was significant moderate-to-strong overlap between the achievement variables, as correlations between these points ranged from .29 to .86. Of central importance were correlations between achievement points and the predictor variable, the TOLT. The strongest TOLT prediction was exam points ($r = .29$) followed by the total points ($r = .19$), each demonstrating significant weak-to-moderate-sized relationships. No significant relationships were found between laboratory points, quiz points, and the TOLT scores, with laboratory points having the smallest correlation ($r = .04$). Laboratory points are a result of group work, which could explain the lack of correlation since it does not directly associate to a single individual's reasoning ability. The lack of correlation with quiz points ($r = .15$) is likely due to the quiz question being recall and not problem solving. However, the correlation between laboratory, exam and quiz points, and total points were the highest measured ($r = .86$, $r = .66$, $r = .51$) respectively. This would be expected, in that, the higher points earned on these sub-values would equate to higher total points earned, but these relationships is not a part of the study's hypothesis under investigation. All other variables are associated with the individual student. The

positive correlations between the TOLT scores and the significant achievement exam and total points confirmed our expectations based on previous literature.

Table 1
Bivariate Correlations between Variables (N = 152)

		1	2	3	4	5
1	TOLT Score	1				
2	Laboratory Points	.035	1			
3	Exam Points	.285**	.207*	1		
4	Quiz Points	.149	.332**	.295**	1	
5	Total Points	.191*	.858**	.655**	.510**	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

The goal of this study was to investigate the achievement measures of laboratory, quiz, exam, and total points by semester type. In the current analysis, a one-way ANOVA between the independent predictive variable, semester type, was conducted for all achievement measures, i.e. laboratory, exam, quiz, and total points. Descriptive statistics for the four achievement measures are provided in Table 2, along with *p* values and effect sizes (Cohen's *d*) for significantly different scores. Effect size is a statistic that quantifies the difference between two groups emphasizing the size of the difference. For example, how many students get high lab points for every student that does not get high lab points? High *d* values equates to a stronger chance. Significant differences were found with all of the dependent variables. The first achievement measure was the lab points. The summer mini-mester students scored significantly greater points than the fall/spring semester students did. With respect to quiz points, the summer mini-mester students again scored significantly greater points than the fall/spring semester students. The achievement measure that does not follow suit is the exam points. The fall/spring semester students scored significantly greater points than the summer mini-mester students did. Finally, the summer mini-mester students once more scored significantly greater points than the fall/spring semester students did on the total points. The achievement measure of lab points demonstrated a large effect size, while all other effect size values would be considered medium.

Table 2
Achievement Statistics between Semester Types (*N* = 152)

Achievement	Semester Type	Mean	*SD*	*p* value	Effect size (*d*)
Lab Points					
	Mini-mester	543.16	31.88	0.000**	0.66
	Fall/Spring	516.21	48.50		
Quiz Points					
	Mini-mester	45.88	19.99	0.028*	0.36
	Fall/Spring	39.85	12.55		
Exam Points					
	Mini-mester	206.15	30.12	0.041*	-0.34
	Fall/Spring	216.01	28.75		
Total Points					
	Mini-mester	841.15	54.72	0.017*	0.39
	Fall/Spring	817.20	66.94		

** Value is significant at the 0.01 level (2-tailed).
* Value is significant at the 0.05 level (2-tailed).

Limitations

The limitations of the study are that overall construction surveying achievement was investigated, but not achievement on an item-by-item basis or on different outcome measures. Additionally, the use of group scoring on laboratory points was not examined; the lack of motivation/effort on behalf of one student in a group could have detrimental effects on the overall group's score, which was not explored in this study. Further, the study was not able to definitively identify why the existing differences between the reasoning ability scores and achievement points were obtained. It is questionable if the students scoring low on the TOLT really have a deficiency in their reasoning ability or if there was a potential lack of motivation in taking the TOLT. If it was the latter, this lack of motivation carried over to their level of effort in the course. Another factor that potentially has an effect upon student achievement is course load. It likely is inappropriate to compare May mini-mester to fall/spring semester achievement on this variable, because we do know why fall/spring semester students scored higher on some of the achievement measures and lower on others. It could be a lack of cognitive load, more relaxed, higher motivation or even that higher achieving students may be the students that enroll in the May mini-mester. These unmeasured factors may cause the May mini-mester students to score higher on quizzes and labs, which would earn them higher total points. Finally, while a variety of reasoning ability tasks were used in this study; not all possible measures of cognitive abilities were used.

Conclusions

The goal of this study was to explore the differences in academic performance between students who took the traditional 15 week fall and spring semester courses and students that took the compressed 10 day May mini-mester course of construction surveying. This study found that students taking the mini-mester course had significantly better achievement on the laboratory activities, the readings quizzes, and total course grade points than that of the students taking the traditional semester course. These findings support the research of Scott & Conrad (1991) and Austin & Gustafson (2006). This is likely because of the heavy immersion into the topic of the course work in addition to the lack of intervening distractions.

However, in this study the students taking the traditional semester courses significantly exhibit better achievement on the two course exams than did the students taking the mini-mester course. Meta-study research has demonstrated that exams given at the end of a full semester course requires a longer retention period than an exams administered during and after a compressed semester (Daniel, 2000). Cognitive science research suggests that spaced-out instruction would enhance learning because of an increase in study time and practice. Specifically, research has found that when learning and practice periods are spaced out over a longer time rather than compressed in time, long-term memory of the new information is improved (Donovan & Radosevich, 1999; Krug, Davis, & Glover, 1990). It is likely that the construction students understand the extended times between learning and testing required of a full semester and therefore commit information to longer retention and recall; where in the compressed semester they do not have time between learning and testing. Course content that is largely characterized by affective or rote memory learning might be amenable to a reduced course length format (Petrowsky, 1996). Petrowsky found that students in two-week courses did worse on exams requiring comprehension, application, and analysis than did full semester students. A longitudinal study including an analysis of exam content and academic performance would be a wise addition to this research. Finally, the question begs; is the knowledge retained over time between the two semester types? This, again, would be an interesting research project and is needed to assist in further semester type evaluation.

There were no instructional design differences between semester types with respect to instruction, materials, activities, applications, or exams; just time compression between the two semester types which is similar to the Allen et al. (1982) study. By using actual grade book data, this study is also able to show that the higher grades were a reflection of increased student academic achievement. In that all dependent variables were strictly controlled, it is appropriate for this study to assert that the increase in student achievement is not a reflection of the instructor lowering the bar during the compressed semester as described in Austin & Gustafson (2006).

Additionally, the instructor has observed the following of student behavior. Students have reported that they like the mini-mester better because they can get it over with quickly. Several students, who enroll in the mini-mester, fail to take into account that it is a 10 day, 10 hours a day commitment and quickly drop the course. Often students do not read the catalog that states it is a two credit hour course with a four-hour laboratory and recitation. Students do not believe the workload matches the credit hours received and are often aggressive in stating their negative opinion. This may be the case. In the senior exit survey, conducted by the Department Head, the surveying course is always evaluated as one of the most difficult and as one of the best courses taken. Bt is always being ranked in the top five in both categories.

Future research might include investigating student attitudes through course evaluations between semester types, but the university does not evaluate summer courses course offering, in that, they do not offer summer courses except in special circumstances. Our industry supports the construction summer program by annually providing approximately $140,000 to match the $90,000 of university funding. This makes the current study of the same courses a bit precarious because the potential for a lack of funding. If this industry funding resource were to cease, so would the summer offering of construction surveying.

Finally, it should be noted that the TOLT and other psychometric tests are an excellent and necessary research tool for providing equal sample comparisons of data between groups. Often construction educators conduct research across multiple groups of students or classes, they report findings without ever providing evidence that the groups investigated are from the same general population. For example, one would evaluate course performance from an architecture offering of structures against a construction offering of structures without ever utilizing any factor that would equalize the groups. Some would argue that the homogeneity of variance test provides evidence for group equalization. The homogeneity of variance test within an ANOVA statistical analysis investigates whether all groups have the same or similar variance. One data set may have been collected from a group of students from a major research institution and the other data set from students enrolled in a non-research undergraduate university. These sample populations are not the same because enrollment criterions between these universities would be significantly different and would not represent the same student populations. In this example, if the variance of scores analyzed are similar in variance on the values tested then it would pass the test of homogeneity of variance, but it would still be measuring the variance of two unequal groups. Studied groups must be measured on a non-confounded construct that both groups would have in common and, to be compared, must be equivalent on that construct. Reasoning ability and logical thinking is not context bound and provides an excellent measure to equate groups prior to investigating any differences between control and experimental groups. This is a research concept that has been overlooked in much of construction education's research.

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Appendix A

FALL COSC 301 Lab Schedule

(This is a tentative schedule and is subject to change at the discretion of the instructor.)

Date	Activity Assignments	Readings and Viewings	Submissions Due
	Purchase web-based textbook access. **Purchase surveyors field book.** **Download and install required software.**	**Materials -** ***Prior to Class;*** On-line at: http://www.constructedllc.org/; Elan (E64-8x4); orange hardback; Software as per your personal technology needs **Readings -** ***Prior to Class;*** Syllabus	
Week #1 Monday, 8/29/2015	**Start and Finish Course Setup.** **Required Recitation, FRAN Room 102, 5:45 PM.** **Activity Deliverables:** • Equipment Inventory/Check-out. • Making a PDF Document.	**Readings** - Due by Monday, 9/5/2015 @ 5:30 PM; FRAN Room 120, PDF Doc; Surveying Equipment, PDF Doc; Example Locker & Equipment Form, PDF Doc; Field Book Setup, PDF Doc; Activity I, PDF Doc **Viewings** - Due by Monday, 9/5/2015 @ 5:30 PM; Web Site Use, Video - 4:30 Min.; Video Textbook - Chapter 1, External Web Link; Activity I, Part #1 - Field Book Setup, Video - 6:32 Min.; Activity I, Part #2 - Field Book Entries, Video - 6:16 Min.; Activity I, Part #3 - Sketching Video, - 4:33 Min.	**Equipment Inventory/Check-out Contract; Due Friday 9/2/2015 @ 12:00 Noon. All crew members must be present.** **Send yourself an scanned and edited PDF document; Due Friday 9/2/2015 @ 12:00 Noon.**
Week #2 Monday, 9/5/2015	**Start Activity I.** *Site Orientation and Pacing Sloped Distance.* **Recitation, FRAN Room 102, 5:45 PM** - *AutoCAD.* • Heron's Formula for Area - Web-based App **Activity Deliverables:** • *Submission 1 - FBSU.pdf* • *Submission 2 - A1FB.pdf* • *Submission 3 - A1S.pdf*	**Readings** - Due by Monday, 9/12/2015 @ 5:30 PM; AutoCAD Instructions - PDF Doc; AutoCAD Commands - PDF Doc; Activity Rework - PDF Doc; Activity II - PDF **Viewings** - Due by Monday, 9/12/2015 @ 5:30 PM; Textbook - Chapter 2 - External Web Link; Activity II, Part #1 - Field Book Entries, Video - 5:00 Min.; Activity II, Part #2 - Drawing Video - 16:23 Min.	
Week #3 Monday, 9/12/2015	**Start Activity II.** *Tape calibration and taping horizontal chain distance.* **Recitation, FRAN Room 102, 5:45 PM.** • AutoCAD A2D Template **Activity Deliverables:** • *Submission 1 - A2FB.pdf* • *Submission 2 - A2P.pdf* • *Submission 3 - A2D.dwg*	**Readings** - Due by Monday, 9/19/2015 @ 5:30 PM; Instrument Leveling - Web-based App; Tripod and Instrument Setup - PDF Doc; Tripod Nomenclature - PDF Doc; CST-Burger_SAL24N Manual - PDF Doc; Sight Level Measures - PDF Doc; Activity III - PDF Doc **Viewings** - Due by Monday, 9/19/2015 @ 5:30 PM; Textbook - Chapter 3 - External Web Link; Tripod Setup, Video Demonstration - 4:45 Min.; Level Setup, Video Demonstration - 3:24 Min.; Activity III, Parts #1 & #2 - Field Work, Video - 6:17 Min.; Activity III, Parts #1 & #2 - Field Book Entries, Video - 6:57 Min.	**Activity I, Site Orientation and Pacing Sloped Distance; Due Monday 9/12/2015 @ 5:30 PM.**
Week #4 Monday 9/19/2015	**Start Activity III.** *Two-peg test and closed leveling of vertical distances.* **Recitation, FRAN Room 102; 5:45 PM.** **Activity Deliverables:** • *Submission 1 - A3TP.pdf* • *Submission 2 - A3FB.pdf*	**Readings** - Due by Monday, 9/26/2015 @ 5:30 PM; Conversion Instructions - PDF Doc; Stadia Measures - PDF Doc; Activity IV - PDF Doc **Viewings** - Due by Monday, 9/26/2015 @ 5:30 PM; BS, FS and Angle, Video Demonstration - 5:04 Min.; Grade Rod, Video Demonstration - 2:35 Min.; Tripod, Video Demonstration - 5:31 Min.; Activity IV, Part #1 - Field Book Entries, Video - 5:20 Min.; Activity IV, Part #2 - AutoCAD Drawing, Video - 23:34 Min.	**Activity II, Tape Calibration and Taping Horizontal Chain Distance; Due Monday 9/19/2015 @ 5:30 PM.**
Week #5 Monday 9/26/2015	**Start Activity IV.** *Field traverse to establish temporary bench mark (TBM).* **Recitation, FRAN Room 102, 5:30 PM.** • AutoCAD A4D(A, B, or C) Template **Activity Deliverables:** • *Submission 1 - A4FB(A, B or C).pdf* • *Submission 2 - A4D(A, B or C).dwg*	**Materials** - Due by Monday, 10/3/2015 @ 5:30 PM; Glo-Orange Stake Flags – 18" (100-Pack); Home Depot or Lowe's Home Improvement **Readings** - Due by Monday, 10/3/2015 @ 5:30 PM; Theodolite Use - PDF Doc; Manual - PDF Doc; Quick Start - PDF Doc; Activity V - PDF Doc **Viewings** - Due by Monday, 10/3/2015 @ 5:30 PM; Contour Leveling Explination, Video - 9:45 Min.; Activity V, Part #1 - Field Book Entries, Video - 5:38 Min.; Activity V, Part #2 - Excel File Video - 2:48 Min.; Data Submission Video - 2:50 Min.	**Activity III, Two-peg test and closed leveling of vertical distances; Due Monday 9/26/2015 @ 5:30 PM.**
Week #6 Monday 10/3/2015	**Start Activity V.** *Site contours and profile leveling.* **Recitation, FRAN Room 102, 5:30 PM.** • Excel Activity V Worksheet - MS Excel File Download **Activity Deliverables:** • *Submission 1 - A5FB.pdf* • *Submission 2 - A5CT.xlsx*	**Readings** - Due by Monday, 10/10/2015 @ 5:30 PM; Exam #1 Specifications - PDF Doc; Activity Rework - PDF Doc	**Activity IV, Field traverse to establish temporary bench mark (TBM); Due Monday 10/3/2015 @ 5:30 PM.**
Week #7 Monday 10/10/2015	**Exam #1, FRAN Room 102, 5:45 PM.** **Start Rework.** *Activity Rework.* **No Recitation.** Activity Deliverables: • *Submissions as Require by Reworked Activity*	**Readings** - Due by Monday, 10/17/2015 @ 5:30 PM; Chapters 4 & 5 - External Web Link; Activity VI - PDF Doc	**Activity V, Site contours and profile leveling; Due Friday 10/14/2015 @ 5:00 PM.**
Week #8 Monday 10/17/2015	**Start Activity VI.** *Existing buildings (As-built) and vertical angles using a transit.* **Recitation, FRAN Room 102, 5:30 PM.** **Activity Deliverables:** • *Submission 1 - A6FB.pdf*	Readings - Due by Monday, 10/24/2015 @ 5:30 PM; Chapter 6 - External Web Link; Activity VII - PDF Doc	
Week #9 Monday 10/24/2015	**Start Activity VII.** *Basic theodolite operations and closed circuit angles.* **Recitation, FRAN Room 102, 5:45 PM.** • AutoCAD A7D Template **Activity Deliverables:** • *Submission 1 - A7FB.pdf* • *Submission 2 - A7D.pdf*	**Materials** - Due by Monday, 10/31/2015 @ 6:35 PM; 1 in. x 2 in. x 1-1/2 ft. Untreated Pine Grade Stakes (12-Pack); Home Depot or Lowe's Home Improvement; 48 in. Wood Lath (50-Bundle); Lowe's Home Improvement (Share between Crews) **Readings** - Due by Monday, 10/31/2015 @ 5:30 PM; Chapter 7 - External Web Link; Total Station Use - Unique to your crew.; Instructions - PDF Doc; Card - PDF Doc; Manual - PDF Doc; Quick Start - PDF Doc; Activity VIII - PDF Doc **Viewings** - Due by Monday, 10/31/2015 @ 5:30 PM; Activity VIII, Part #1 - Field Book Setup, Video - 5:02 Min.; Activity VIII, Part #2 - Field Work Exp., Video - 16:11 Min.	**Activity VI, Existing buildings (As-built) and vertical angles using a transit; Due Monday 10/24/2015 @ 5:30 PM.**
Week #10 Monday 10/31/2015	**Group I - Start Activity VIII.** *Total station layout of drilled building piers.* **Recitation, FRAN Room 102, 5:45 PM.** • Evaluation Form - Download PDF Doc **Activity Deliverables:** • *Submission 1 - A8FB.pdf* • *TA Graded - A8E.pdf*	**Readings** - Due by Monday, 10/14/2015 @ 5:30 PM; Chapter 8 - External Web Link; Activity IX - PDF Doc	**Activity VII, Basic theodolite operations and closed circuit angles; Due Monday 10/31/2015 @ 5:30 PM.**
Week #11 Monday 11/7/2015	**Group II - Start Activity VIII.** *Total station layout of drilled building piers.* No **Recitation.** • Evaluation Form - Download PDF Doc **Activity Deliverables:** • *Submission 1 - A8FB.pdf* • *TA Graded - A8E.pdf*	**Readings** - Due by Monday, 10/14/2015 @ 5:30 PM; Chapter 8 - External Web Link; Activity IX - PDF Doc	**Group I - Activity VIII, Total station layout of drilled building piers; Due Monday 11/7/2015 @ 5:30 PM.**
Week #12 Monday 11/14/2015	**Group II - Start Activity IX.** *Total station site surveys.* **No Recitation.** • AutoCAD A9D Template **Activity Deliverables:** • *Submission 1 - A9FB.dwg* • *Submission 2 - A9D.dwg*	**Readings** - Due by Monday, 11/28/2015 @ 5:30 PM; Exam #2 Specifications - PDF Doc	**Group II - Activity VIII, Total station layout of drilled building piers; Due Monday 11/14/2015 @ 5:30 PM.** **Activity IX, Total station site surveys; Due Friday 11/18/2015 @ 5:30 PM.**
Week #13 Monday 11/21/2015	**Thanksgiving Holliday** **No Recitation or Lab.**		
Week #14 Monday 11/28/2015	**EXAM #2, FRAN Room 102, 5:45 PM.** ***Locker cleanup.*** *Remove all materials that were not there when you first inventoried your locker.*		
Week #15 Monday 12/5/2015	**Equipment Inventory and Deficite Notivication.** **No Recitation.** **No Lab Meeting.** **Rain Float Week.** *Week held in reserve to make up a rainy day.*		**Clean equipment and locker; Due Friday 12/9/2015 @ 12:00 Noon.**

Appendix B

SUMMER COSC 301 Lab Schedule

(This is a tentative schedule and is subject to change at the discretion of the instructor.)

Date		Activity Assignments	Readings and Viewings Due	Submissions Due
Prior to First Class		**Purchase web-based textbook access.** **Purchase surveyors field book and course materials.** **Download and install required software.**	**Readings** -FRAN Room 120, PDF Doc; Surveying Equipment, PDF Doc; Example Locker & Equipment Form, PDF Doc **Viewings** -Web Site Use, Video - 4:30 Min.	
Day #1 Monday 5/16/2015	***Morning***	**Start and Finish Course Setup Work.** **Recitation, FRAN Room 102, 8:00 AM.** **Activity Deliverables:** • Equipment inventory and check-out. • Make and send yourself a PDF document.	**Readings** - Field Book Setup, PDF Doc; Activity I, PDF Doc **Viewings** - Textbook - Chapter 1, External Web Link; Activity I, Part #1 - Field Book Setup, Video - 6:32 Min.; Activity I, Part #2 - Field Book Entries, Video - 6:16 Min.; Activity I, Part #3 - Sketching Video, - 4:33 Min.	**Equipment Inventory/Check-out; Due Monday 5/16/2015 @ 12:00 Noon. All crew members must be present.**
	Afternoon	**Start and Finish Activity I.** *Site Orientation and Pacing Sloped Distance.* **Recitation, FRAN Room 102, 5:00 PM** - *Voluntary, AutoCAD.* Heron's Formula for Area - Web-based App **Activity Deliverables:** • *Submission 1 - FBSU.pdf* • *Submission 2 - A1FB.pdf* • *Submission 3 - A1S.pdf*	**Readings** - AutoCAD Instructions - PDF Doc; AutoCAD Commands - PDF Doc; Activity Rework - PDF Doc; Activity II - PDF Doc **Viewings** - Textbook - Chapter 2 - External Web Link; Activity II, Part #1 - Field Book Entries, Video - 5:00 Min.; Activity II, Part #2 - Drawing Video - 16:23 Min.	**Making a PDF Document. - Specifications; Due Monday 5/16/2015. Send yourself a PDF file document.**
Day #2 Tuesday 5/17/2015	***Morning***	**Start Activity II.** *Tape calibration and taping horizontal chain distance.* **Recitation, FRAN Room 102, 8:00 AM.** AutoCAD A2D Template **Activity Deliverables:** • *Submission 1 - A2FB.pdf* • *Submission 2 - A2P.pdf* • *Submission 3 - A2D.dwg*	**Readings** - Instrument Leveling - Web-based App; Tripod and Instrument Setup - PDF Doc; Tripod Nomenclature - PDF Doc; CST-Burger_SAL24N Manual - PDF Doc; Sight Level Measures - PDF Doc; Activity III - PDF Doc **Viewings** - Textbook - Chapter 3 - External Web Link; Tripod Setup, Video Demonstration - 4:45 Min.; Level Setup, Video Demonstration - 3:24 Min.; Activity III, Parts #1 & #2 - Field Work, Video - 6:17 Min.; Activity III, Parts #1 & #2 - Field Book Entries, Video - 6:57 Min.	**Activity I, Site Orientation and Pacing Sloped Distance; Due Tuesday 5/17/2015 @ 7:30 AM.**
	Afternoon	**Continue Activity II and Start Activity III.** *Two-peg test and closed leveling of vertical distances.* **Recitation, FRAN Room 102; 12:00 Noon.** **Activity Deliverables:** • *Submission 1 - A3TP.pdf* • *Submission 2 - A3FB.pdf*	**Readings** - Conversion Instructions - PDF Doc; Stadia Measures - PDF Doc; Activity IV - PDF Doc **Viewings** - BS, FS and Angle, Video Demonstration - 5:04 Min.; Grade Rod, Video Demonstration - 2:35 Min.; Tripod, Video Demonstration - 5:31 Min.; Activity IV, Part #1 - Field Book Entries, Video - 5:20 Min.; Activity IV, Part #2 - AutoCAD Drawing, Video - 23:34 Min.	
Day #3 Wednesday 5/18/2015	***Morning***	**Finish Activity II and Continue Activity III.** **No Recitation**		
	Afternoon	**Finish Activity III and Start Activity IV.** *Field traverse to establish temporary bench mark (TBM).* **Recitation, FRAN Room 102, 12:00 Noon.** AutoCAD A4D(A, B, or C) Template **Activity Deliverables:** • *Submission 1 - A4FB(A, B or C).pdf* • *Submission 2 - A4D(A, B or C).dwg*	**Readings** - Theodolite Use - PDF Doc; Manual - PDF Doc; Quick Start - PDF Doc; Activity V - PDF Doc **Viewings** - Contour Leveling Explination, Video - 9:45 Min.; Activity V, Part #1 - Field Book Entries, Video - 5:38 Min.; Activity V, Part #2 - Excel File Video - 2:48 Min.; Data Submission Video - 2:50 Min.	**Activity II, Tape Calibration and Taping Horizontal Chain Distance; Due Wednesday 5/18/2015 @ 12:00 Noon.**
Day #4 Thursday 5/19/2015	***Morning***	**Continue Activity IV.** **No Recitation.**		**Activity III, Two-peg test and closed leveling of vertical distances; Due Thursday 5/19/2015 @ 7:30 AM.**
	Afternoon	**Finish Activity IV and Start Activity V.** *Site contours and profile leveling.* **Recitation, FRAN Room 102, 12:00 Noon.** Excel Activity V Worksheet - MS Excel File Download **Activity Deliverables:** • *Submission 1 - A5FB.pdf* • *Submission 2 - A5CT.xlsx*	**Readings** - Exam #1 Specifications - PDF Doc	**Activity IV, Field traverse to establish temporary bench mark (TBM); Due Thursday 5/19/2015 @ 12:00 Noon.**
Day #5 Friday 5/20/2015	***Morning***	**Finish Activity V and Start Rework.** *Activity Rework.* **Recitation, FRAN Room 102, 8:00 AM.** Activity Deliverables: • *Submissions as Require by Reworked Activity*		
	Afternoon	**Continue Rework.** **No Recitation.**	**Readings** - Chapters 4 & 5 - External Web Link; Activity VI - PDF Doc	**Activity V, Site contours and profile leveling; Friday 5/20/2015 @ 12:00 Noon.**
Day #6 Monday 5/23/2015	***Morning***	**Finish Rework and EXAM #1. FRAN Room 102, 9:30 AM.** **Recitation, FRAN Room 102, 11:00 AM.**		**Activity Rework; Due Monday 5/23/2015 @ 7:30 AM.** **Exam #1; FRAN Room 102; Monday, May 23, 2015 at 9:30 AM.**
	Afternoon	**Start Activity VI.** *Existing buildings (As-built) and vertical angles using a transit.* **Activity Deliverables:** • *Submission 1 - A6FB.pdf*	**Readings** - Chapter 6 - External Web Link; Activity VII - PDF Doc	
Day #7 Tuesday 5/24/2015	***Morning***	**Finish Activity VI and Start Activity VII.** *Basic theodolite operations and closed circuit angles.* **Recitation, FRAN Room 102, 8:00 AM.** AutoCAD A7D Template **Activity Deliverables:** • *Submission 1 - A7FB.pdf* • *Submission 2 - A7D.pdf*	**Readings** - Chapter 7 - External Web Link; Total Station Use - Unique to your crew.; Instructions - PDF Doc; Card - PDF Doc; Manual - PDF Doc; Quick Start - PDF Doc; Activity VIII - PDF Doc **Viewings** - Activity VIII, Part #1 - Field Book Setup, Video - 5:02 Min.; Activity VIII, Part #2 - Field Work Exp., Video - 16:11 Min.	
	Afternoon	**Continue Activity VII.** **No Recitation.**		**Activity VI, Existing buildings (As-built) and vertical angles using a transit; Due Tuesday 5/24/2015 @ 12:00 Noon.**
Day #8 Wednesday 5/25/2015	***Morning***	**Finish Activity VII and Start Activity VIII.** *Total station layout of drilled building piers.* **Recitation, FRAN Room 102, 8:00 AM.** Evaluation Form - Download PDF Doc **Activity Deliverables:** • *Submission 1 - A8FB.pdf* • *I or SW Graded - A8E.pdf*		**Activity VII, Basic theodolite operations and closed circuit angles; Due Wednesday 5/25/2015 @ 7:30 AM.**
	Afternoon	**Continue Activity VIII.** **No Recitation.**	**Readings** - Chapter 8 - External Web Link; Activity IX - PDF Doc	
Day #9 Thursday 5/26/2015	***Morning***	**Finish Activity VIII and Start Activity IX.** *Total station site surveys.* **Recitation, FRAN Room 102, 8:00 AM.** AutoCAD A9D Template **Activity Deliverables:** • *Submission 1 - A9FB.dwg* • *Submission 2 - A9D.dwg*		
	Afternoon	**Continue Activity IX.** **No Recitation.**	**Readings** - Exam #2 Specifications - PDF Doc	**Activity VIII, Total station layout of drilled building piers; Due Thursday 5/26/2015 @ 12:00 Noon.**
Day #10 Friday 5/27/2015	***Morning***	**Finish Activity IX and Study Period.** **Recitation, FRAN Room 102, 8:00 AM.** ***Rain Float Period.*** *(If a previous day was rained out, this period will be used for lab activity.)*	**Readings** - Students Review Chapters 1–3; Study Chapters 4–8, including the Glossary of Terms; Activities VI through IX	
	Afternoon	**EXAM #2. FRAN Room 102, 12:00 Noon.** ***Rain Float Period.*** *(If a previous day was rained out, this period will be used for lab activity and the exam will be on Saturday.)* ***Locker cleanup.*** *Remove all materials that were not there when you first inventoried your locker.*		**Activity IX, Total station site surveys; Due Friday 5/27/2015 @ 12:30 Noon.** **Exam #2; FRAN Room 102; Friday, May 27, 2015 at 12:00 Noon.**
Day #11 Saturday 5/28/2015	***Morning***	**Rain Float Day.** *Day held in reserve to make up a rainy day.* Crews clean equipment and locker.		
	Afternoon	**Check-in and Inventory.** **No Recitation.** **No Lab Meeting.** Equipment Inventory/Inspection.		**Clean equipment and locker.**