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Report

East Los Angeles College
ES 224 FS Test Prep Course 2020

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Executive Summary

- 0.1 This evaluation report has been prepared by REAP Change Consultants (REAP Change) for the East Los Angeles College (ELAC) A T E grant 1801188 “Filling Skills Gap Through the Geospatial Engineering and Technology Program.” The grant and its evaluation are funded by the National Science Foundation (NSF). A primary long-term goal of the grant is to increase the number of Latinx people and women who are licensed Land Surveyors or engaged in land surveying related professions.
- 0.2 The report concern ELAC course ES 224 offered online because of the COVID-19 pandemic during the first summer term of 2020. The course provides preparation for students to take the national Fundamentals of Surveying (FS) test, one of the requirements for people to use the title “Land Surveyor in Training.” Passing the FS test is a first step toward eventually becoming a licensed Land Surveyor.
- 0.3 The report is based on an online survey of the 21 students in the ES 224 class taken during the last week of class and open between July 13 and 20, 2020 but no one responded after July 16, 2020. The survey had an excellent response rate of 81 percent. However, since the class is small, the 17 students who responded are too few to allow valid and reliable parametric statistical analysis.
- 0.4 The respondents included 12 Latino (male) students and four non-Latinx students (including one woman). ELAC is a Hispanic Serving Institution and to date the grant project has been doing well in attracting Latino men into its community college courses, although in small numbers. As with this course, however, to date it has failed to attract more than one or two women, Latina or otherwise who are community college age or above.¹
- 0.5 Like all ELAC classes, ES 224 was open to older adults, including working adults, such as those who might already be working in Land Surveying or related professions. In fact, almost two-thirds of the students (65%) were age 30 or older, including 58% of the Latino men. That few women were in the class and responded to the survey also reflects the current scarcity of women in Land Surveying or related professions.
- 0.6 Questions might not have been clear, but it appears that 43% of Latinos and half of the non-Latino students would be eligible for the “Land Surveyor in Training” title after passing the FS Exam. Most did intend taking the FS Exam soon (one month to one year)
- 0.7 The course was exceptionally well received with “Very Good” plus “Good” ratings totaling near to over 90% on all questions for the entire class. Only one person used the “Poor” category on one question and no one ever used the “Very Poor” category.
- 0.8 Open-ended comments confirmed that this was a generally well-designed, well-presented, well-received, informative course, according to the students. Students especially appreciated the problem based approach, and being able to study using the types of problems likely to be encountered in practice on the

¹ The ATE project also offers courses to high school students and, as detailed in other evaluation reports, it does attract women.

FS Test. The professor might have provided a little more explanation of some of the solutions. Most comments favored the instructional style although one or two thought the professor could have been better prepared. The course time and amount of time spent was considered a problem for some working adults. The course was time-consuming over a five week period. However, in response to another survey question there was no agreement on a better time for doing a synchronous course.

- 0.9 Students most often mentioned the boundary law area of the course as the one which was hardest for them to understand and for which they needed the most additional review. This is understandable, and was predicted by the professor, since most students going through the sequence of ELAC Land Survey courses had not yet taken an ELAC boundary control course offered in the next 2020 summer session.
- 0.10 The survey probed about future types of instruction and modes of instructional delivery. The students strongly favored a lecture/discussion format, but proportionally more non-Latinos than Latinos did so. Latinos favored a lecture/discussion format followed by a sample test. Online pre-recorded instruction available 24/7 was strongly favored or favored over in-person, in classroom instruction 73% to 57% but 20% of the respondents opposed or strongly opposed both types of instruction. What was done this year was strongly favored for next time by one-third of respondents, favored by 27%, with 27% neutral (all Latinos) and 13% opposed (again all Latinos). The plurality of respondents (40%) were neutral about “Blended” instruction (partly online, partly in-person, in classroom).
- 0.11 In relation to grant goals, before even taking the course nearly nine out of ten students (88%) agreed or strongly agreed that they had career plans in which land surveying could be a useful skill, including 91% of Latinos and 80% of the non-Latinos. The course did not change that.
- 0.12 The proportion of all students who strongly agreed or agreed that they intended to become professional Land Surveyors went from 57% before the course to 69% after it, but the net difference is one or two people because of the small numbers in the class.
- 0.13 The proportions of students who strongly agreed that they had long-term goals of obtaining a Land Surveyor license increased from 19% to 44% (including 18% to 45% for Latinos and 20% to 40% for non-Latinos).
- 0.14 Particularly hopeful for grant success is an increase among students in confidence that they can pass the FS exam. Before the course about one out of three students (31%) were confident that they could pass the FS exam, but after the course more than eight out of ten (82%) were confident that they can pass the FS exam. That included 64% (10) of the Latinos who agreed and one Latino who strongly agreed after the course that they could pass the FS Exam.
- 0.15 Students were more interested than ever in land surveying after the course (80% of Latinos and all non-Latinos) and clearly understood all the steps needed to become a professional land surveyor (94% of Latinos and all non-Latinos).
- 0.16 Paying the \$175 fee out of the ATE grant funds is not strictly speaking necessary for most students since they would take the exam anyway despite the fee. However, paying it would help a few and might speed up when some took the FS Exam since they would not have to save up to be able to afford the fee.

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Overview

- 1.1. This evaluation report has been prepared by REAP Change Consultants (REAP Change) for the East Los Angeles College (ELAC) A T E grant 1801188 “Filling Skills Gap Through the Geospatial Engineering and Technology Program.” The grant and its evaluation are funded by the National Science Foundation (NSF). As part of the grant evaluation Dr. Stephen C. Maack, Owner of REAP Change Consultants, surveyed 21 students of ES 224, an ELAC course to prepare students to take the national Fundamentals of Surveying (FS) exam, which is an essential first step toward becoming a professional surveyor. People who successfully pass this examination and meet education or experience requirements can use the title “Land Surveyor in Training.”
- 1.2. The course was presented online because ELAC was closed for in-person instruction or events due to the COVID-19 pandemic that led to “stay at home” orders for surrounding cities, counties and throughout California to prevent the spread of the virus. The survey was done online for similar reasons, using the Survey Monkey account maintained by REAP Change. The survey was not password protected. It had 14 questions, mostly “closed,” on six pages.
- 1.3. The course instructor, Dr. Humberto Gallegos, who is also the Principal Investigator for the project, did all the recruitment of respondents from the ES 224 summer class, including several reminders and the offer of 5 points extra credit for the course for those saying on an honor system that they had responded. Although the survey was left open until 11:45 p.m. on Monday, July 20, 2020, all the responses came in between July 13 and 16, 2020. Of the 21 students in the class, 17 responded for an excellent response rate of 81 percent.

Findings and Analysis

Findings and Analysis Approach

- 2.1. The number of survey respondents (17) is too small to allow for valid and reliable parametric statistical analysis. Even presentation of charts and graphs could be visually misleading. The analysis is therefore restricted to presentations of counts and percentages. The results should be interpreted only as the opinions of the respondents and cannot be statistically projected to represent the opinions of all ES 224 students because the respondents are self-selected rather than randomly chosen. However, the strong response rate provides a good data set to let us gain insights into the students taking the FS Test Prep course online during the middle of a pandemic.

Demographics

- 3.1. Survey respondents included 16 males (94%), and one (1) female (6%). To protect confidentiality of the responses of the lone female respondent, no analysis of results will be presented by gender even though one focus of the grant is to encourage more females to obtain land survey related degrees or certificates and enter related fields. Except among the high school classes, the number of females taking ELAC land survey courses has consistently been small, with only one or two females responding to the evaluation surveys. The grant project could do a better job of trying to recruit females of community college age or

older to take its Land Survey courses. However, the low proportion of females taking ES 224 also reflects the fact that there are few females currently working in the Land Surveying field at present.

- 3.2. The majority (71% or 12) of the students self-identified as Latinos (with all Latinx students indicating that they are males). Three students (8%) identified themselves as “White or Caucasian” with one of these also declaring himself to be a Latino. and one student (6%) each self-identified as “Black or African American,” “Asian or Asian American” and “Other (American)”. ELAC is a Hispanic Serving Institution near a larger Latinx neighborhood and the Engineering Department has been doing a consistently good job enrolling Latinx students, particularly males (Latinos) in its Land Surveying courses.² Since the grant is focused on encouraging more Latinx people into Land Surveying courses and Land Surveying related careers, we will analyze below any differences in responses of the 12 Latinos and the 5 non-Latino students (men of different ethnic/”race” identity and the one woman). Again, because of the small numbers involved we will not be exploring for statistically significant differences by ethnicity but will point out some especially noticeable percentage differences in responses.³
- 3.3 For this course there was an important difference in age among the respondents. The survey asked students to self-identify their age range, starting with “Under 20” and then proceeding in five-year intervals to the final category of “65 or older.” Because of skews in the responses for different age ranges, and to protect confidentiality, we collapsed the results into Table 1.

Table 1. Age Ranges of Survey Respondents

	Latino		Not Latino		All Respondents	
29 or younger	5	42%	1	20%	6	35%
30 to 39	6	50%	1	20%	7	41%
40 or older	1	8%	3	60%	4	24%
Total	12	100%	5	100%	17	100%

As shown in Table 1, 92% of the Latinos were under age 40, compared to 60% of the non-Latinos age 40 or older. In addition, half of the Latinos were ages 30 to 39 (and one was age 45 to 49). This distribution underscores two points. First, 64.7% of the FS Test Prep course respondents were age 30 or older which

² The latest data available for East Los Angeles College on the National Center for Education Statistics “College Navigator Online” website <https://nces.ed.gov/collegenavigator/?q=East+Los+Angeles+College&s=all&id=113856#enrolmt> on July 29, 2020 shows the total student enrollment as 67% Hispanic/Latino, 12% race/ethnicity unknown, 8% Asian, 6% White, 5% Black or African American, 1% two or more races, and 1% non-resident alien. In addition to being located near a largely Latinx neighborhood, the college is located next to one of two predominantly Chinese communities in Los Angeles. Based on the survey results, other than attracting students from the predominantly Chinese (Asian) community (who may be under-represented in the Land Surveying community), the ES 224 course of summer 2020 attracted students relatively represent of those attending ELAC.

³ Among Latino respondents one student represents $1/12 = 8.3\%$ of all Latino responses and among Non-Latino students one student represents $1/5 = 20.0\%$ of all non-Latino responses. The percentages increase if one student does not answer a question. More than two Latinos would be needed to exceed one non-Latino response. Therefore, in general not too much should be read into interpretation of even apparently large percentage differences of Latino and non-Latino responses.

is above the usual age found among community college students. This is especially noticeable among the Non-Latino students, 80% of whom were age 30 or older. Few Latinos are already working in the field.

Educational and Experience Backgrounds of Students

- 4.1. In order to be certified in California as a “Land Surveyor in Training” one must pass the National Council of Examiners for Engineering and Surveying (NCEES) “Fundamentals of Surveying” (FS) test and have two years of postsecondary (college-level) land surveying education, OR two years or more of land surveying-related work experience OR a combination of postsecondary college-level land surveying education and land surveying-related work experience totaling two year. The FS test is the first of two national and one state-specific test that must be passed, along with experience and other requirements, for people seeking to be licensed as professional land surveyors in California. It is therefore relevant for purposes of the NSF project to evaluate both the education and experience backgrounds of students in ES 224, since the course might attract not only ELAC students who have already been taking one or two years of land surveying courses at the community college (or elsewhere) but also people already working in land surveying who are seeking career advancement by becoming eligible for the “Land Surveyor in Training” certification. How ready are the students before taking ES 224 to take the FS test, and are they ready because of education or experience or both? The answer to these questions could affect both how ES 224 is taught and the likelihood of successful completion of the FS test soon, which is a measurable element of the ATE project evaluation.
- 4.2 A closer look at student backgrounds provides further insights into who attended the course, as shown in Table 2 below. In Table 2 the bolded and light gray highlighted responses are the total survey responses and the two lines below show the breakout of Latino (Latinx male) responses versus the responses of any other respondents. There were 17 total respondents, including 12 Latinos and 5 other people, and not everyone answered all the sub-questions. Therefore small differences in the number of “yes” and “no” responses can result in large percentage differences.
- 4.3. looking first at similarities of the Latino and other subgroups, everyone in both groups had a high school diploma or GED. Anyone who had earned an Associate or B.S. degree would have taken two or more years of higher education courses, but those might or might not be land survey related. One-quarter of each group had an Associate degree in a STEM field and One Latino and one other respondent had earned a baccalaureate degree in a STEM field (which again might or might not be land survey related). The large percentage difference in Latinos and other students in having earned a baccalaureate degree in a STEM field is not considered important because only three of the five other students answered this sub-question. Obtaining a STEM related Associate or baccalaureate degree would indicate a certain familiarity or facility with scientific, technical, engineering, or mathematical subjects, although that might not specifically relate directly to facility in land surveying. That 50% (two of four) other students compared to zero Latino students had an Associate degree in a non-STEM field is interesting in terms of general educational background, but not so important as a qualification for taking the FS test and might be an artifact of community college students who did take prior land surveying classes at ELAC taking this course as well. While none of the other students had a baccalaureate degree in a non-STEM field, one Latino did, which could indicate a switch in career focus on his part.

Table 2. Educational and Experience Backgrounds of ES 224 Students

Question 5. Have you already completed (please respond to each row):

	Yes		No		Total
A high school diploma or GED	100%	17	0	0	17
Latino	100%	12	0	0	12
Not Latino	100%	5	0	0	5
An Associate degree in a STEM field	25%	4	75%	12	16
Latino	25%	3	75%	9	12
Not Latino	25%	1	75%	3	4
An Associate degree in a non-STEM field	13%	2	87%	14	16
Latino		0	100%	12	12
Not Latino	50%	2	50%	2	4
A bachelor's degree in a STEM field	13%	2	87%	13	15
Latino	8%	1	92%	11	12
Not Latino	33%	1	67%	2	3
A bachelor's degree in a non-STEM field	7%	1	93%	13	14
Latino	9%	1	90%	10	11
Not Latino		0	100%	3	3
Two years of postsecondary (college-level) land surveying education	19%	3	81%	13	16
Latino	8%	1	92%	11	12
Not Latino	50%	2	50%	2	4
Two or more years of land surveying related work experience	7%	1	93%	14	15
Latino	8%	1	92%	11	12
Not Latino		0	100%	3	3
A combination of postsecondary (college level) land surveying education and land surveying related work experience totaling two years	27%	4	73%	11	15
Latino	33%	4	67%	8	12
Not Latino		0	100%	3	3

- 4.4. In order to obtain a better sense of how close the students in the class might be to becoming certified Land Surveyors in Training if they passed the FS exam, Question 5 of the survey had sub-questions asking about years of experience background and the combination of college-level education and experience in education totaling two or more years. The responses to these-sub-questions give us a sense of how quickly students would qualify for Land Surveyor in Training certification should they pass the FS exam on first try. The three sub-questions were not mutually exclusive. That is, a student might answer “yes” to more than one of the sub-questions. However, a close look at the actual response distribution indicated that only one student (a Latino) answered “Yes” to more than one of the sub-

questions. That is, other than that one Latino, after passing the FS exam any particular student would qualify right away for the Land Surveyor in Training certification either on the basis of his or her education, or on the basis of his or her experience, and not have to rely on a combination of education and experience to qualify.

- 4.5. One Latino (8%) and two of four Other students (50%) would qualify because of two or more years of land survey-related postsecondary education alone. One Latino, but none of the non-Latino students would qualify because of two or more years of land-surveying related work experience alone. However, four Latinos (including the one just mentioned), compared to none of the non-Latino students, would qualify immediately for the certification on the basis of a combination of work experience and some college level education in land surveying – if they passed the FS exam. In other words, $1+1+4-1=5$ of the 12 Latinos (42%) of the Latinos taking the course would qualify immediately to apply for Land Surveyor in Training certification through either education, or experience, or a combination of both totaling two or more years if they passed the FS exam. That compares favorably with the 50% of other (non-Latino) students who would qualify immediately for the certification (on the basis of their education alone).⁴ The numbers are too small to make a firm conclusion, but providing Latinos with both educational and experience ways to qualify for Land Surveyor in Training certification appears to be a good approach.

Table 3. Student Expectations of When They Would Take the FS Exam

Answer Choices	Responses		Latinos		Not Latino	
In the next month or earlier	31%	5	36%	4	20%	1
in more than one to six months from now	19%	3	9%	1	40%	2
in over six to 11 months from now	19%	3	18%	2	20%	1
A year or more from now		0		0		0
The next time it is offered	19%	3	27%	3		0
When I have enough money to afford the fee	6%	1		0	20%	1
I'm not sure	19%	3	18%	2	20%	1
I don't intend to take the FS test		0		0		0
Answers		16	11		5	
Skipped		1	1		0	

- 4.6. As shown in Table 3 above, none of the respondents, Latino or non-Latino, had taken the FS Exam previously. Except for one Latino who did not answer the question at all, all students in the class expected to take the FS exam. The exam was offered in July 2020, with the next offering in October 2020. The survey asked the students when they expected to take the FS exam. While the question allowed for multiple choices (since the exam may be taken more than once), only two respondents chose more than one time period. A Latino answered both “the next time it is offered” and that he was not sure. A non-Latino answered both “in the next month or earlier” and “when I have enough money to pay the

⁴ One of the five non-Latino students chose not to answer Question 5 at all so there is not evidence available from the survey as to how close in time that student might be to obtaining the Land Surveyor in training certification.

fee.” Otherwise, the responses in Table 3 are mutually exclusive. Latinos were most likely to expect to take the test “in the next month or so” or “the next time it is offered.” The responses of the non-Latinos are fairly evenly distributed although the most frequent answer is “in more than one to six months to now. The overall response distribution indicates that most students expect to take the FS test either in the July or the October sitting, allowing for some ambiguity in the “next time it is offered response.” However, almost one in five took the course but expect to take the FS Exam over six months to 11 months later, and an equal proportion were not sure when they would take the test.

Opinions About the Test Prep Course

5.1. According to the NCEES website, as of July 1, 2020 the FS Exam covers seven areas as follows:

- 1) Surveying Processes and Methods
- 2) Mapping Processes and Methods
- 3) Boundary Law and Real Property Principles
- 4) Surveying Principles
- 5) Survey Computations and Computer Applications
- 6) Business Concepts
- 7) Applied Mathematics and Statistics

The course reviewed all these areas to some extent. Of these topics, Dr. Humberto Gallegos, the PI for the grant, thought that some of the students might need to take ELAC’s course ES 225 Boundary Control for Surveyors before taking the FS exam. ELAC is offering ES 225 in the second summer term (July 20, 2020 to August 23, 2020), shortly after the ES 224 course ended. Some students may be planning to take that course before attempting the FS exam in the October 2020 sitting or later.

5.2. The survey asked students to rate the Test Prep course on a series of criteria using a scale of “Very Good” to “Very Poor”. All students answered all questions, except for one Latino who answered none of the questions. Table 4 shows the results of the questions in the order asked, with the overall responses and the question at the top of each section of the table, then Latino and finally non-Latino responses. To fit the Table on the page the “Very Poor” column has been deleted in Table 4 since no one used it for any of the ratings. The course was exceptionally well received with “Very Good” plus “Good” ratings totaling over 90% on all but one question for the entire class. Even on the questions about “Instructional Style” the combined “Very Good” plus “Good” ratings for the whole class was nearly as high, 88%.⁵

⁵ For an opinion survey of this sort it is common to have two-thirds to three-quarters of the respondents use the top two ratings of a five-point scale, no matter what the question content. To have over four-fifths (80%) of the class use the top two ratings on all measures is almost unheard of and indicates an exceptionally well-delivered and well-received class.

Table 4. Student Ratings of ES 224 Course on Selected Criteria

	Very Good		Good		Fair		Poor		Total
Overall course	56%	9	31%	5	13%	2		0	16
Latino	55%	6	27%	3	18%	2		0	11
Not Latino	60%	3	40%	2		0		0	5
Instructional style	63%	10	25%	4	6%	1	6%	1	16
Latino	55%	6	27%	3	9%	1	9%	1	11
Not Latino	80%	4	20%	1		0		0	5
Time allotted for questions	81%	13	13%	2	6%	1		0	16
Latino	91%	10		0	9%	1		0	11
Not Latino	60%	3	40%	2		0		0	5
Responses to questions (in general)	69%	11	25%	4	6%	1		0	16
Latino	64%	7	27%	3	9%	1		0	11
Not Latino	80%	4	20%	1		0		0	5
Subject matter covered	44%	7	44%	7	13%	2		0	16
Latino	46%	5	46%	5	9%	1		0	11
Not Latino	40%	2	40%	2	20%	1		0	5
Information about areas exam covers	56%	9	38%	6	6%	1		0	16
Latino	55%	6	36%	4	9%	1		0	11
Not Latino	60%	3	40%	2		0		0	5
Information about types of questions to expect	69%	11	25%	4	6%	1		0	16
Latino	64%	7	27%	3	9%	1		0	11
Not Latino	80%	4	20%	1		0		0	5

5.3. The students rated the time allotted for questions the highest, with 81% (including 91% of Latinos) giving that category a “Very Good” rating. Tied for second best with 69% “Very Good” and 25% “Good” ratings were “Information about types of questions to expects” and instructor “Responses to questions asked (in general)” during the class. In both cases the non-Latinos gave higher ratings to these criteria (80% “Very Good”) and one Latino gave a “Fair” rating. Adjusting for the tie for second place, the fourth highest in the rank order concerned “Instructional Style” with overall ratings of 63% “Very Good” and 25% “Good,” but one Latino rated the instructors style as “Fair” and this is the only category that another Latino rated “Poor.” The fifth best rating concerned “Information about areas the exam covers (56% “Very Good” and 38% “Good”) with close agreement of Latinos and non-Latinos on the scoring. Sixth place goes to the “Overall Course” ratings, also with 56% “Very Good” but 31% “Good” ratings and two Latinos rated the Overall Course as “Fair.” Non-Latinos appreciated it more than Latinos, but only because a greater percentage of the five non-Latino respondents chose a “Good” rating. Least well appreciated was the “Subject matter covered” with 44% rating that “Very Good” and 44% “Good” with essentially the same agreement on those ratings among Latinos and Non-Latinos and one (of 5) non-Latinos versus one (of 11) Latinos giving that a “Fair” rating. This rating is curious since the course was specifically designed to cover the subject matter covered in the FS test.

- 5.4. The survey asked students to provide open-ended responses concerning “The best things about the course” (16 responses), “The worst things about the course” (15 responses), and what was “okay but could have been better” (13 responses). The answers to those questions are provided in Tables 5 to 7.

Table 5. Best Thing about the Course

Latino Responses (11)	Non-Latino Responses (5)
The facility and flexibility that the professor offers	Available through community college.
The knowledge it gives you to potential obtain a job with land surveying	The fact that the course is available online through a community college and
was going over each problem in both of the manuals.	It was very informative with lots of information and short cuts using the computer
amount of problems done	Learning environment.
working out problems similar to those in the FS test.	The hands on problem.
gave examples of how the test will be	
The Class is fun and very interesting, I love the word Problems and Way the professor approaches the class	
Very dynamic and lots of information that's help to understand the subject	
The instructor and the format. Being able to review the recording of the class is priceless!!	
Getting a feel to the exam.	
It was straight forward	

Table 6. Worst Thing about the Course

Latino Responses (11)	Non-Latino Responses (4)
classes were not prepared in advance.	Lab is unavailable due to Covid-19
class time for full time workers	The long lectures
Real time consuming	No comment.
going without breaks kind of made me doze off a bit.	Nothing
it is only a 5 week course. time too early	
Class meeting too early	
The time of the class meetings	
online course	
COVID-19	
Not sure about this.	
N/A	

Table 7. Okay but could have been better

Latino Responses (10)	Non-Latino Responses (3)
the course went pretty well and smooth.	Difficult to locate specific problem # on the videos
need to prepared classes in advance.	Quizzes
more homework	No comment.
Possibly more HW problems	
explaining some of the solutions	
Yes evening classes are the best specially for people that work	
yes, may be have the class available in the evenings	
Yes, in person instruction	
I'm person	
Not sure about this.	

- 5.5. Summarizing across Tables 5 to 7, as usual with open-ended responses, sometimes different responses contradict one another based on personal preferences and opinions. However, there does not seem to be a great deal of difference between Latino and non-Latino responses to the course. Students especially appreciated the problem based approach, and being able to study using the types of problems likely to be encountered in practice on the FS Test. Some liked hands-on problems, others word problems, and some even wanted more homework. However the professor might have provided a little more explanation of some of the solutions. Most comments favored the instructional style although one or two thought that more advance preparation for the classes would have helped. The relatively early start time of the course was an issue, possibly contributing to one or two sleepy students at points when the presentation became more boring. One person did not like long lectures. The course time and amount of time spent was considered a problem for working adults. The course was time-consuming over a five week period (it was a summer short term course). While some people appreciated the online instruction format required by COVID-19 “stay at home” restrictions, others preferred in-person instruction and noted the disadvantage of having no lab facilities available. A few students offered specific comments that can be considered during the next time the course is offered, such as the difficulty of locating specific problems when viewing videos. Overall the positive, negative and “okay but could have been better” comments confirmed the course ratings. This was a generally well-designed, well-presented, well-received, informative course, according to the students.
- 5.6. In an attempt to probe more deeply into student reactions, the survey asked students to indicate what they struggled with, what wasn't clear in the course, and where they felt they needed more review (at the time the course was just ending). The answers to these questions are shown in Tables 8, 9, and 10. Summarizing Tables 8 to 10, the comments again suggest that the course presentation itself was clear in general and as a result of the course on self-reflection many students in the class, Latino and non-Latino alike, were able to identify areas in which they needed more review, learning or work before attempting the FS test. This is a positive outcome since students already motivated to take the test are more likely to undertake further specific work they think that they need to do before attempting the test. It is a

reasonable assumption that if they do the specific additional study and work in areas that they have identified that might increase their chances of successfully passing the FS Test. Notable in the responses of all three Tables is the mention of needing to review and/or struggling with boundary law, concepts and issues, which the instructor predicted, and which is one of the major topical areas in the test. That a few students mentioned mathematics or some aspect of mathematics or problem solving is not surprising, since mathematical facility is a major feature of land surveying work and mathematics knowledge would be needed to pass two of the seven areas covered in the FS Test. Some of the comments, such as about definitions or vocabulary may indicate that a few students simply had not taken enough academic courses in land surveying (yet) or had not paid enough attention in the courses that they took, or they didn't know terms in unfamiliar areas like boundary control or celestial navigation as related to land surveying. The comment about "time management" is interesting but ambiguous since it might relate to the timed FS Test (and the practice test in the course), or to difficulties of time management in an online course, or the troubles mentioned by some working adults in taking a synchronous online course (with homework) while also doing paying work.

Table 8. What Students Struggled With

Latino Responses (10)	Non-Latino Responses (3)
the boundary topics and some surveying terms I had not seen.	Boundary problems.
Some of the topics I haven't seen before.	The boundary questions.
My personal lack of some concepts' understating	Difficulty storing dms in calculator memory
Some of the surveying specific vocabulary	
definitions	
math	
some problems were difficult	
Studying some questions	
Time management	
Being able to attend Zoom lecture because of work	

Table 9. What Was not Clear

Latino Responses (6)	Non-Latino Responses (3)
boundary problems	The boundary questions.
boundary control	Celestial observations
some examples	No comment.
all was clear after attending to the meeting in class	
everything was pretty clear.	
N/A	

Table 10. Where Students Need More Review

Latino Responses (9)	Non-Latino Responses (3)
I need to review the boundary topics more, and also some fundamental surveying procedures.	The boundary questions.
I need more math and boundary related problems.	Practicing more problems.
Mathematics	Vertical curves
Problem solving	
Astronomy/Trivial knowledge about land surveying	
Definitions	
Field experience	
I need to review all topics in order to be ready for the exam	
Overall everything to get better at land surveying questions	

- 5.7. The Summer 2020 ES 224 class was presented online because online learning was the only type of course delivery allowed during the COVID-19 pandemic physical distancing and “stay at home” mandates. However, ELAC has presented this class in a face-to-face format in 2019 and potentially has a variety of ways in which it might structure the course presentation in the future. To help with planning future versions of this course, the survey asked students to rate various course delivery options on a scale of “Strongly Favor” to “Strongly Oppose.” The results are shown in Table 11 below.
- 5.8. The ES 224 students in this class strongly favored a lecture/discussion format, but proportionally more non-Latinos than Latinos responded that way. On the other hand, Latinos strongly favored or favored a lecture/discussion format followed by a sample test about twice as often as non-Latinos did. Online pre-recorded instruction available 24/7 was strongly favored or favored over in-person, in classroom instruction 73% to 57% but 20% of the respondents opposed or strongly opposed both types of instruction. The slightly less controversial option is in-person, in-classroom instruction because 13% about that compared to 7% about the videotaped online instruction available 24/7, but we are only dealing with a difference of one person. So either of those approaches might work. What was done this year was strongly favored for next time by 33% of respondents, favored by 27%, with 27% neutral (all Latinos) and 13% opposed (again all Latinos). The plurality of respondents (40%) were neutral about “Blended” instruction (partly online, partly in-person, in classroom), with one-third strongly favoring it, but just over one-quarter (26%) opposed or strongly opposed. So support for that option might be characterized as lukewarm. Opinions about online instruction but at a different time were relatively evenly split, with 38% strongly favoring or favoring that option, 31% neutral, and 31% opposed or strongly opposed. This finding offsets the open-ended comments made earlier complaining about the time that the course was offered. There does not seem to be overwhelming support for changing the time. What works for some people simply may not work for others. Changing the days that the course is offered had the least strong opinions, with 31% neutral, 31% favoring, only 13% strongly favoring that move and 13% each opposing or strongly opposing it. It seems like it might be difficult to find days and times that work for everyone or most people and the students may recognize that.

Table 11. Student Preferences for Potential Future ES 224 Class Delivery

	Strongly Favor		Favor		Neutral		Oppose		Strongly Oppose		All
A lecture/discussion format	56%	9	19%	3	19%	3	0	0	6%	1	16
Latino	46%	5	27%	3	18%	2		0	9%	1	11
Not Latino	80%	4		0	20%	1		0		0	5
Lecture/discussion followed by a sample test	47%	7	27%	4	27%	4	0	0	0	0	15
Latino	55%	6	27%	3	18%	2		0		0	11
Not Latino	25%	1	25%	1	50%	2		0		0	4
In-person, in classroom instruction	40%	6	27%	4	13%	2	7%	1	13%	2	15
Latino	46%	5	27%	3	9%	1	9%	1	9%	1	11
Not Latino	25%	1	25%	1	25%	1		0	25%	1	4
Online instruction but pre-recorded, available 24/7	53%	8	20%	3	7%	1	13%	2	7%	1	15
Latino	55%	6	18%	2	9%	1	18%	2		0	11
Not Latino	50%	2	25%	1		0		0	25%	1	4
"Blended" instruction (partly online, partly in-person in classroom)	33%	5		0	40%	6	13%	2	13%	2	15
Latino	27%	3		0	46%	5	18%	2	9%	1	11
Not Latino	50%	2		0	25%	1		0	25%	1	4
Online, with a live instructor, but on different days	13%	2	31%	5	31%	5	13%	2	13%	2	16
Latino		0	36%	4	36%	4	9%	1	18%	2	11
Not Latino	40%	2	20%	1	20%	1	20%	1		0	5
Online, with a live instructor, but at a different time	25%	4	13%	2	31%	5	19%	3	13%	2	16
Latino	27%	3	18%	2	27%	3	18%	2	9%	1	11
Not Latino	20%	1		0	40%	2	20%	1	20%	1	5
Just like it was done this summer	33%	5	27%	4	27%	4	13%	2		0	15
Latino	27%	3	18%	2	36%	4	18%	2		0	11
Not Latino	50%	2	50%	2		0		0		0	4

Outcomes or Short-term Impact of the ES 224 FS Test Prep Course.

- 6.1. The students should have gained certain knowledge regarding the FS Test and by the end of the course have some idea of whether they had sufficient academic and experience background to be eligible to attempt the test. Table 12 shows student self-reflection about those expected course outcomes. Eligibility to take the FS Exam is based on years of academic work, years of experience, or some

combination of those. Did the students understand the requirements and based on their self-reflection about their own amount of academic and experience backgrounds in land surveying, did they think that they are currently eligible to take the FS Exam?

Table 12. Student Eligibility to take the FS Test (Knowledge and Self-Reflection)

	Yes		Not Sure		No		Total
Have you completed all requirements to take the FS Test now?	56%	9	25%	4	19%	3	16
Latino	64%	7	18%	2	18%	2	11
Not Latino	40%	2	40%	2	20%	1	5
Do you need more academic courses before taking the FS Test?	50%	8	19%	3	31%	5	16
Latino	27%	3	27%	3	46%	5	11
Not Latino	100%	5		0		0	5
Do you need more experience before taking the FS Test?	63%	10	19%	3	19%	3	16
Latino	64%	7	18%	2	18%	2	11
Not Latino	60%	3	20%	1	20%	1	5

- 6.2 All but one of the students answered the questions in Table 12 and 75% to 80% were able to respond with a definite “yes” or “no” concerning their eligibility to take the FS exam by the end of the ES 224 course. About one-quarter of the class, (40% or two of the five non-Latinos and 18% or two of the 11 Latinos), were left unsure about whether they had completed all the requirements to take the FS Test right away at the end of the course. Half of the students, including all the non-Latinos, indicated that they needed more academic courses before taking the FS Exam. About 31% of the total class, including 46% of the Latinos and none of the non-Latinos were sure that they did not need more academic work before taking the exam. However, about 63% of the total class – both Latino and non-Latino – indicated that they needed more experience before taking the FS test. This is self-reflection rather than actual eligibility.
- 6.3. Considering the wording of the questions and the recognized need of some for more education and/or experience with boundary issues, the responses here may reflect student perceptions of where they need more academic or work experience before taking the test, rather than self-reported eligibility for the “land surveyor in training” title as explored in relation to Table 2 responses.. There appears to be but is not a discrepancy between the figures in Table 2 and those in Table 12. In the earlier table just over one quarter (27%) of all students, including one-third of the Latinos and none of the non-Latinos, indicated that they had a combination of postsecondary land surveying education and land surveying related work experience, which would make them eligible for the title, if verified. Yet in Table 12, over twice as many students (56% including 64% of Latinos and 40% of non-Latinos) indicate that they don’t feel ready to pass the FS Exam, the other requirement for using the title “Land Surveyor in Training,” , and could be answered “yes,” “no,” or “don’t know” by students even if they meet the work plus experience requirements for the Land Surveyor in Training title. The other two sub-questions covered in Table 12 concern perceived need for more academic work or more experience before taking the FS Exam.

- 6.4. There was an additional sub-question included with the sub-questions whose response distribution is shown in Table 12. That sub-question asked students to respond “Yes,” “Not Sure,” or “No” to the question “Do you understand the steps needed to become a professional Land Surveyor?” “More than four out of every five respondents (81% of Latinos and 82% of non-Latinos) responded “Yes,” while the rest answered “Not Sure.” Most students did understand those steps by the end of the ES 224 course, even if a few were perhaps unclear on some of the details of the requirements.

Attitude and Intention Course Outcomes

- 7.1. The ATE grant has several medium and long-term outcomes that will be difficult to measure directly. However, at the end of the ES 224 course we asked students to reflect and rate their intentions and attitudes concerning five items before they had taken the course. Then in the next question we asked the students to rate their intentions and attitudes about four of those items since taking the course. Rather than looking at individual changes in Table 13 we explored the aggregate totals before taking the course and in Table 14 at the aggregate totals after taking the course. The difference in aggregate opinions gives a sense of the overall influence of the course on items relevant to the ATE grant goals. If there is no aggregate change in the distribution (especially if the students agreed or strongly agreed with a statement before taking the course) it may mean that the course did not motivate them further on that particular item or change the direction in which they were already headed. Since one is looking at aggregate rather than individual changes no change in percentage distribution could mean that while some students were more favorable toward land surveying by the end of the course and some were less favorable, there was no net impact of this course. However, if there is a noticeable increase in the strength of agreement, the course has helped move students in the direction favored by grant goals. Finally, the small numbers involved may yield relatively important looking percentage changes, especially for the five non-Latinos, without much net aggregate change -- only changes in opinions of one or two individuals.
- 7.2. Based on the results shown in Table 13, before taking the ES 224 course, nearly nine out of ten students (88%) agreed or strongly agreed that they had career plans in which land surveying could be a useful skill, including 91% of Latinos and 80% of the non-Latinos. The course would be unlikely to change that viewpoint for most students. However, fewer than six out of ten (57%) agreed or strongly agreed that they intended to obtain a Land Surveyor license or become professional Land Surveyors. Since the ATE grant is focused specifically on Latinx it is somewhat positive for grant purposes that slightly more than six out of ten of the Latinos (63%) agree or strongly agree that one of their long-term goals is to obtain a Land Surveyor license or that they intend to become a professional Land Surveyor. Before taking the course under one-third of all the students agreed or strongly agreed that they could pass the FS exam. That included just over one-quarter of the Latinos (27%), compared to 40% of the non-Latinos, and none of the Latinos strongly agreed that they could pass the FS exam. Did that change because of the course? Before taking the course three-quarters of the students correctly disagreed or strongly disagreed that passing the FS exam was all that they needed to do to become a licensed Land Surveyor. That correct response was given by 82% of the Latinos, compared to 60% of the non-Latinos. We conclude from this analysis that most of the Latinos already understood that it would take more than the FS exam to obtain the Land Surveyor license that more than six out of ten wanted to obtain, only just over a quarter were confident before the course that they could pass that exam.

Table 13. Attitudes and Intentions about Land Surveying BEFORE taking ES 224

	Strongly Agree		Agree		Neither Agree nor Disagree		Disagree		Strongly Disagree		Total
One of my long-term goals is to obtain a Land Surveyor license	19%	3	38%	6	25%	4	19%	3		0	16
Latino	18%	2	45%	5	18%	2	18%	2		0	11
Not Latino	20%	1	20%	1	40%	2	20%	1		0	5
I intend to become a professional Land Surveyor	19%	3	38%	6	38%	6	6%	1		0	16
Latino	27%	3	36%	4	27%	3	9%	1		0	11
Not Latino		0	40%	2	60%	3		0		0	5
I have other career plans in which Land Surveying can be a useful skill	50%	8	38%	6		0	6%	1	6%	1	16
Latino	55%	6	36%	4		0		0	9%	1	11
Not Latino	40%	2	40%	2		0	20%	1		0	5
I was confident that I could pass the FS exam	6%	1	25%	4	38%	6	31%	5		0	16
Latino	0%	0	27%	3	36%	4	36%	4		0	11
Not Latino	20%	1	20%	1	40%	2	20%	1		0	5
Passing the FS exam is all I need to do to be a licensed Land Surveyor	0%	0		0	25%	4	50%	8	25%	4	16
Latino	0%	0		0	18%	2	55%	6	27%	3	11
Not Latino	0%	0		0	40%	2	40%	2	20%	1	5

7.3. Did the FX exam prep course change intentions, or confidence levels? Table 14 shows the post-course results. As expected, overall the FS test prep course didn't change career plans in that about nine out of ten students (88%) still agreed or strongly agreed that they had other career plans in which they feel Land Surveying can be a useful skill, and that still includes 91% of Latinos, and 80% of non-Latinos. However, one more Latino and one more non-Latino strongly agreed with the statement, so the test prep course might have been confirmatory of prior career goals for a few students. Findings favorable to the ATE grant goals are that the proportions of students who strongly agreed that they had long-term goals of obtaining a Land Surveyor license increased from 19% to 44% (including 18% to 45% for Latinos and 20% to 40% for non-Latinos). One more non-Latino also agreed with that statement, raising agreement from 38% to 44% of all students. Said another way, before the course under six out of ten students (57%) agreed or strongly agreed that they had a long-term goal of obtaining a Land Survey license, while after the course almost nine out of ten (88%) of students agreed or strongly agreed with that statement and the strength of the agreement level had increased.

Table 14. Attitudes and Intentions about Land Surveying AFTER taking ES 224

	Strongly Agree		Agree		Neither Agree nor Disagree		Disagree		Strongly Disagree		Total
One of my long-term goals is to obtain a Land Surveyor license	44%	7	44%	7	6%	1	6%	1		0	16
Latino	45%	5	45%	5		0	9%	1		0	11
Not Latino	40%	2	40%	2	20%	1		0		0	5
I intend to become a professional Land Surveyor	31%	5	38%	6	25%	4	6%	1		0	16
Latino	27%	3	45%	5	18%	2	9%	1		0	11
Not Latino	40%	2	20%	1	40%	2		0		0	5
I have other career plans in which Land Surveying can be a useful skill	63%	10	25%	4	0%	0	6%	1	6.3%	1	16
Latino	64%	7	27%	3		0		0	9.1%	1	11
Not Latino	60%	3	20%	1		0	20%	1		0	5
I am confident that I could pass the FS exam	19%	3	63%	10	19%	3		0		0	16
Latino	9%	1	64%	7	27%	3		0		0	11
Not Latino	40%	2	60%	3		0		0		0	5

- 7.4. Furthermore, the proportion of all course students who strongly agreed or agreed that they intended to become professional Land Surveyors went from 57% before the course to 69% after it. If the students follow through on their intentions, the grant and this course will have contributed to an increase in the number of licensed Land Surveyors, and the number of professional Land Surveyors, if only by a few people. However, the increase from this course is more likely to come from non-Latinos than from Latinos. The number of Latinos who strongly agreed that they intended to become professional Land Surveyors stayed constant after the course at three, and the number who agree about that went from four to five. On the other hand the number of non-Latinos who intend to become land surveyors increased from two who agreed before the course to two who strongly agreed plus one more who agreed by the end of the course. This course by itself only partially succeeded in helping the grant along toward its goals, but the direction of movement is positive.
- 7.5. Particularly hopeful for grant success is an increase among students in confidence that they can pass the FS exam. The 2020 FS exam prep course did a good job in increasing student confidence, especially Latino student confidence, that they can pass the exam. While only about one out of three students (31%) were confident before the course that they could pass the FS exam, over eight out of ten (82%) were confident that they can pass the FS exam. That notably includes 64% (10) of the Latinos who agreed and one Latino who strongly agreed. All the non-Latinos either strongly agreed (40%) or agreed (60%) that they could pass the exam.

- 7.6 The survey had two more questions that were only asked concerning student opinions at the end of the course. They check on increase in interest in land surveying and on whether the students were clear about the steps needed to become a licensed Land Surveyor. The responses are shown in Table 15. The course did a good job in communicating the steps needed to become a licensed Land Surveyor and interested almost all students more than ever in Land Surveying. Overall almost nine out of 10 (86%) agreed or strongly agreed that they were more interested than ever in land surveying. That included 80% of Latinos and all the non-Latinos. Similarly, overall about nine out of ten students agreed or strongly agreed that they were clear about the steps needed to become a licensed Land Surveyor, including all but one of the Latinos and all the non-Latinos.

Table 15. Increase in Interest in Land Surveying & Knowledge about Licensure AFTER taking ES 224

	Strongly Agree		Agree		Neither Agree nor Disagree		Disagree		Strongly Disagree		Total
I am more interested than ever in Land Surveying	33%	5	53%	8	13%	2		0		0	15
Latino	40%	4	40%	4	20%	2		0		0	10
Not Latino	20%	1	80%	4		0		0		0	5
I am clear on all of the steps needed to become a professional Land Surveyor	44%	7	50%	8	6%	1		0		0	16
Latino	45%	5	45%	5	9%	1		0		0	11
Not Latino	40%	2	60%	3		0		0		0	5

Effect of the \$175 FS Exam Fee on Taking the Test

- 8.1. The final question of the survey was prefaced with an explanation that there is a \$175 fee paid directly to NCEES by anyone seeking to take the FS Exam. If this fee was an impediment to students taking the survey, the principle investigator was considering paying the fee for ES 224 students out of the ATE grant funds (if allowed by grant rules). However the ATE grant funds are limited and it might not be necessary to do that if students did not view the fee as a problem that would prevent them from taking the FS Exam. So after explaining the fee the question probed students in four ways as shown in Table 16.
- 8.2. The first point to make about Table 16 is that the \$175 fee is not a deal breaker for many students that would prevent them from taking the test at all if they had to pay for it themselves. Over three-quarters of the students (76%) disagreed or strongly disagreed that they would NOT take the FS test if they had to pay for it themselves. That included 73% of the Latinos and 80% of the non-Latinos. The rest were neutral on the matter – neither agreeing nor disagreeing. When asked directly, over half of the students (51%) agreed or strongly agreed that the \$175 fee is NOT an issue for them regarding taking FS test and about one-quarter (25%) were neutral on the matter. The usual response was “Agree” rather than “Strongly Agree” and those responses were chosen by 45% of the Latinos and 60% of the non-Latinos. Three Latinos (27%) disagreed (none strongly disagreed), and one non-Latino strongly disagreed. Probing further, about seven out of ten students (69%) agreed or strongly agreed that they were willing to

pay the \$175 fee but would have to save up for it. The agreement responses were more likely to come from Latinos (82%) than from non-Latinos (40%). One Latino was neutral, one disagreed while two non-Latinos were neutral and one non-Latino disagreed. No one strongly disagreed that they were willing to pay the fee but would have to save up for it. Finally, about one-third of all the students (32%), including 36% of Latinos and 20% of non-Latinos agreed or strongly agreed that they would take the FS test sooner if someone else paid for it, and over half (56%) were neutral on the matter (55% of Latinos and 60% of non-Latinos). That left two students, one Latino and one non-Latino, disagreeing that they would take the FS Test sooner if someone else paid for it. No one strongly disagreed with that statement.

Table `16. Potential Impact of the \$175 FS Exam Fee on Whether and When Students Took the Test

	Strongly Agree		Agree		Neither Agree nor Disagree		Disagree		Strongly Disagree		Total
I won't take the FS Test if I have to pay the \$175 fee myself.		0		0	25%	4	63%	10	13%	2	16
Latino		0		0	27%	3	64%	7	9%	1	11
Not Latino		0		0	20%	1	60%	3	20%	1	5
The \$175 fee is NOT an issue for me regarding taking the FS Test	13%	2	38%	6	25%	4	19%	3	6%	1	16
Latino	9%	1	36%	4	27%	3	27%	3		0	11
Not Latino	20%	1	40%	2	20%	1		0	20%	1	5
I'm willing to pay the fee myself but need to save up for it.	31%	5	38%	6	19%	3	13%	2		0	16
Latino	27%	3	55%	6	9%	1	9%	1		0	11
Not Latino	40%	2		0	40%	2	20%	1		0	5
I'd try to take the FS Test sooner if someone else paid the fee for me	19%	3	13%	2	56%	9	13%	2		0	16
Latino	18%	2	18%	2	55%	6	9%	1		0	11
Not Latino	20%	1		0	60%	3	20%	1		0	5

8.4. To summarize, the evaluation evidence is mixed. Generally the students were willing to pay the \$175 fee themselves, although in the economic aftermath of the COVID-19 pandemic almost 70% would have to save up for the \$175 if they had to pay the fee themselves. The \$175 fee was something of an issue for about one-quarter of the students. And about one-third would take the FS Exam more quickly if someone else paid the fee. It appears, therefore, that paying the \$175 fee out of the ATE grant funds is not strictly speaking necessary for most students but would help some and might speed up when some took the exam since they wouldn't have to save up for it.

Evaluator Conclusions

- 7.1. In a way the finding presented in paragraph 3.3. and the age range in Table 1 is not surprising since ES 224 is a more advanced course among the Land Survey courses available at ELAC, so one would expect somewhat older students to be taking it. It is also a course preparing students for professional career entry or advancement with the title “Land Surveyor in Training.” As seen in response to some of the other questions, the course is attractive not only to students progressing through the ELAC land surveying course sequence, but also to people who are somewhat older, already working in the field, perhaps seeking to advance their careers toward an eventual Land Surveyor license. The older group includes both Latinos and Non-Latinos already working in the field, but especially Non-Latinos.
- 7.2. People already working in positions related to Land Surveying, but not yet as professionals, are an appropriate market for the course and for eventually increasing the overall number of licensed Land Surveyors, which is a long-term goal of the grant. However, for the grant purpose of increasing the number of Latinos in Land Survey career, marketing the course to current ELAC students going through the sequence of ELAC land surveying courses is also a good strategy, and might provide a few more Latinos than if the course were marketed only to people currently working in land surveying. Finally, among those taking this course, larger proportions of Latinos than Non-Latinos are younger, so that if they do seek Land Survey careers and eventually obtain Land Survey licenses, they might remain in the field for a longer period of time before retirement than Non-Latinos would. This underlines the relevance and importance of the grant targeting Latinx people to become Land Surveyors.
- 7.3. The course was very well done. To have over four-fifths (80%) of the class use the top two ratings on all measures is almost unheard of and indicates an exceptionally well-delivered and well-received class. This also was a generally well-designed, well-presented, well-received, informative course, according to the open-ended comments of the students.
- 7.4. It is important to understand what this course did and did not do in relation to the ATE grant goals. For example, the course really did NOT change general student interest in Land Surveying very much. These are advanced community college students already interested in Land Surveying and people already in the profession who are perhaps seeking to advance in the field. However, the course did a good job in communicating the steps needed to become a licensed Land Surveyor and interested almost all students more than ever in Land Surveying. It also did a good job in increasing student confidence, especially Latino student confidence, that they can pass the FS Exam. At the same time it helped students determine areas that they needed to review further before taking the FS Exam, such as boundary matters. Essentially all the students do intend taking the exam, many in 2020. Given the large number of Latinos in the class, the ES 224 may well help the ATE grant achieve its medium-term outcome of increasing the number of Latinos engaged in the land surveying profession as Land Surveyors in training, although that has yet to be measured by actual taking and successful passing of the FS Exam. And the number of additional Latinx students achieving that status will be small.

APPENDIX A. ES 224 FS Test Prep Course 2020 Survey

ELAC FS Test Prep Course Survey 2020

Introduction

Thank you for taking the ES 224 Fundamentals of Surveying (FS) test preparation course this summer.

The course was partially funded by a National Science Foundation (NSF) grant awarded to ELAC in order to increase the number of licensed professional land surveyors. The grant is being evaluated and this survey is part of that evaluation. Your participation in this survey is voluntary but needed to do a good evaluation. Analysis of its results will help us improve the course for future students and report about the grant to NSF. If you have questions or concerns about the survey and its uses please contact Stephen Maack, Owner and Lead Consultant, REAP Change Consultants as consultant@reapchange.com. Thank you for your help.

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Permission Request

You may refuse to take the survey at all, stop taking it part way through, or not answer specific questions without affecting your grade or ability to take the examination for which you are prepping. Individual results will not be shared with the instructor, only a summary report of class responses. All that we ask is that you respond in the survey as honestly, frankly, and completely as possible. Thank you for taking the FS test preparation course.

* 1. I have read the Introduction, permission request, and survey taking options and voluntarily agree to take this survey

- ☐ Yes (Selecting this response will take you to the rest of the survey)
- ☐ No (Selecting this response will take you to the end of the survey)

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Demographics for Analysis

* 2. What is your gender?

- ☐ Female
- ☐ Male
- ☐ Other
- ☐ Prefer not to answer

* 3. With which of the following ethnic/"racial" groups do you identify yourself (check all that apply)?

- ☐ White or Caucasian
- ☐ Black or African American
- ☐ Latino/a or Latinx
- ☐ Asian or Asian American
- ☐ American Indian or Alaska Native
- ☐ Native Hawaiian or other Pacific Islander
- ☐ Other (please specify)

* 4. How old are you today (please select your age range from the pull-down menu)

5. Have you already completed (please respond to each row):

	Yes	No
A high school diploma or GED	<input type="radio"/>	<input type="radio"/>
An Associate degree in a STEM field	<input type="radio"/>	<input type="radio"/>
An Associate degree in a non-STEM field	<input type="radio"/>	<input type="radio"/>
A bachelor's degree in a STEM field	<input type="radio"/>	<input type="radio"/>
A bachelor's degree in a non-STEM field	<input type="radio"/>	<input type="radio"/>
Two years of postsecondary (college-level) land surveying education	<input type="radio"/>	<input type="radio"/>
Two or more years of land surveying related work experience	<input type="radio"/>	<input type="radio"/>
A combination of postsecondary (college level) land surveying education and land surveying related work experience totaling two years	<input type="radio"/>	<input type="radio"/>

6. Have you previously attempted the Fundamentals of Surveying exam anywhere?

- ☐ No
- ☐ Yes, but I didn't pass it

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Questions about the class

7. Please rate the quality of the Fundamentals of Surveying (FS) test preparation course on the following:

	Very Good	Good	Fair	Poor	Very Poor
Overall course	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Instructional style	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time allotted for questions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Responses to question (in general)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Subject matter covered	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information about areas exam covers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information about types of questions to expect	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. Please comment about the FS test preparation course.

Best thing about the course

Worst thing about the course

Okay but could have been better

What I struggled with

What wasn't clear

Where I need more review

9. COVID-19 rules required an online course this summer. In the future other class delivery options might be possible. How do you think the course should be offered in the future? (Please provide one response per line)

	Strongly Favor	Favor	Neutral	Oppose	Strongly Oppose
A lecture/discussion format	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lecture/discussion followed by a sample test	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In-person, in classroom instruction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online instruction but pre-recorded, available 24/7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"Blended" instruction (partly online, partly in-person in classroom)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online, with a live instructor, but on different days	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online, with a live instructor, but at a different time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Just like it was done this summer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10. When do you expect to take the FS examination in the future? (Check all that apply)

- | | |
|--|---|
| <input type="checkbox"/> In the next month or earlier | <input type="checkbox"/> The next time it is offered |
| <input type="checkbox"/> in more than one to six months from now | <input type="checkbox"/> When I have enough money to afford the fee |
| <input type="checkbox"/> in over six to 11 months from now | <input type="checkbox"/> I'm not sure |
| <input type="checkbox"/> A year or more from now | <input type="checkbox"/> I don't intend to take the FS test |

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Grant Specific Questions

The NSF grant has certain specific goals. Responses to the questions on this page will help us determine to what extent, if at all, participation in the FS Test Prep course contributed to those grant goals.

11. Based on what you learned in this course

	Yes	Not Sure	No
Have you completed all requirements to take the FS Test now?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do you need more academic courses before taking the FS Test?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do you need more experience before taking the FS Test?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do you understand the steps needed to become a professional Land Surveyor?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. Think back to just BEFORE you took this course. At that time to what extent would you have agreed or disagreed with the following statements?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
One of my long-term goals is to obtain a Land Surveyor license	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I intend to become a professional Land Surveyor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have other career plans in which Land Surveying can be a useful skill	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was confident that I could pass the FS exam	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Passing the FS exam is all I need to do to be a licensed Land Surveyor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

13. SINCE taking this course to what extent do you agree or disagree with the following statements?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
One of my long-term goals is to obtain a Land Surveyor license	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I intend to become a professional Land Surveyor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have other professional plans in which Land Surveying can be a useful skill	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am confident that I can pass the FS exam	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more interested than even in Land Surveying	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am clear on all of the steps needed to become a licensed Land Surveyor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. The National Council of Examiners for Engineering and Surveying (NCEES) requires that a \$175 fee be paid directly to it in order to take the Fundamentals of Surveying (FS) test. To what extent do you agree with the following statements?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
I won't take the FS Test if I have to pay the \$175 fee myself.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I'm willing to pay the fee myself but need to save up for it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I'd try to take the FS Test sooner if someone else paid the fee for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The \$175 fee is NOT an issue for me regarding taking the FS Test	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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End of Survey

Thank you for your responses!! Click "Done" to exit this page.

