

Perception of the AC Exam by Pass or Fail Status

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This paper presents the preliminary findings of a study that surveyed nearly 500 students taking the Associate Constructor (AC) exam. The survey was included with the exam package and asked questions related to how long the student prepared, the importance of the exam according to the stakeholders, the similarity of exam content to their course work, and how useful the study material provided by the American Institute of Constructors (AIC) was. The study found that students who passed the exam responded that they studied between 5 and 8 hours, whereas those who failed studied between 1 and 4 hours. Students perceived that the construction industry values the exam only slightly, but this perception did not affect the pass rate. However, the students' perceptions of the level of importance that their department placed on the exam did affect the pass rate. Nearly three quarters of the students responded that the exam content was either "similar" or "very similar" to what they were taught in their course work. The study also found that the AIC-provided study guide was used by 85% of the test takers, with only 6% responding that they felt the resources were "not useful."

Key Words: Associate Constructor Exam, American Institute of Constructors, Preparation, Motivation

Introduction

Since 1971, the American Institute of Constructors (AIC) has advanced the professionalism and ethics of the construction professional (American Institute of Constructors [AIC], 2017a; Sylvester, 2011). In 1993, the AIC, along with 10 other trade and professional associations, created the Constructor Certification Commission (Commission) with the express purpose of developing a nationally recognized qualifying body of professional constructors (Hauck & Rockwell, 1997; Sylvester, 2011). The Commission has two levels of certification: Level 1, the level of an associate constructor (AC); and Level 2, that of a certified professional constructor (CPC). Since the first certification was awarded in 1996, over 25,000 individuals have received one or both AC or CPC certifications under the Commission's leadership (AIC, 2017a). Individuals can earn the AC certification with a combination of a 4-year CM degree or 4 years of qualifying experience and passing the AC exam (AIC, 2016). The AC exam is a paper-based exam given in two 4-hour segments, administered once in late fall and once in late spring of the academic calendar year. Students generally take the exam during the final year of their CM degree program (MacDonald & Sessoms, 2012). The exam consists of 300 questions related to 10 weighted content areas identified by industry professionals as necessary to manage the construction process (AIC, 2016). The exam is accredited by the American National Standards Institute (ANSI), which mandates in part that educators have no prior knowledge of exam questions (AIC, 2017b). Educators may submit potential questions for consideration; however, industry professionals on the Exam Writing Committee (subcommittee of the Commission) must vet all questions for appropriateness before they are included in an exam.

Low-Stakes Tests

The ability to assess student learning using standardized tests is a well-documented challenge (Cole et al, 2008; Erwin & Wise, 2002; Flowers et al., 2001). This problem is particularly acute when the consequences for failure are low for students but high for the students' institutions. The literature has referred to exams given where students perceive the exams as "low-stakes tests" (Cole et al., 2008; Finn, 2015). Depending on how the exam is

administered, the AC exam can be easily classified as a low-stakes test. The AC exam is by no means the only exam associated with the challenge of depressed student motivation. The Collegiate Assessment of Academic Proficiency, College Outcomes Measures Program, College Basic Academic Subjects Examination, and Collegiate Learning Assessment are all standardized higher education cognitive tests associated with the challenge of low student motivation (Cole et al., 2008). As the economy improves, graduating students are receiving more employment offers and are under increasing pressure to accept jobs earlier without necessarily completing or passing industry exams. This can further deflate students' motivation to perform well on the AC exam. Erwin and Wise (2002) put it succinctly: "The challenge to motivate our students to give their best effort when there are few or no personal consequences is probably the most vexing assessment problem we face."

A well-cited model to explain testing results is Wigfield and Eccle's (2000) expectancy-value theory (Cole et al. 2008; Finn 2015). The expectancy-value theory claims that the motivation for students to try hard on low-stakes tests comes from a) the expectation for success and b) the value they place on the task. The expectancy-value theory predicts that when the exam is easier or harder than the test takers believed it would be, their assessment scores are reduced (Finn 2015). When students have a proper expectation of the exam's difficulty, their overall scores will improve and more accurately access their understanding of the material. The AIC provides a study guide, which includes a practice test so that students can gauge the type, style, and difficulty of exam questions (AIC 2016). It is unknown at this time if this resource sufficiently negates the "expectation for success" component as an influential factor in exam results. This aspect of the AC exam is beyond the scope of this study. This study address the value students place on the exam which will be elaborated more later in the paper.

Incorporation of the AC Exam into Construction Management Programs

Only two peer-reviewed publications could be found that address how construction management programs incorporate the AC exam into their program and motivate students to do their best. The first paper, by MacDonald and Sessoms (2012), presents the findings of a short survey of ACCE-accredited programs and their use of the AC exam. The researchers found that about half of the programs that responded required students to take the exam, but the majority of them did not require students to pass it. It is noteworthy that although the vast majority of the programs surveyed did not require students to pass, 80% of the programs used the exam as an assessment tool. This situation sets up the classic "low-stakes test" trap described above, which is likely why nearly half of the programs "incentivized" students in some way. A second study, published in the *Professional Constructor* journal, also surveyed programs that use the AC exam but was much more comprehensive (Burgett, 2017). This study surveyed 23 construction management programs and asked a series of detailed questions related to how the programs help students prepare for the exam and motivate them to do their best. The questions asked by the two studies were not identical but were similar enough for comparisons to be drawn. Similar question(s) that addressed whether the exam was required, whether a minimum score needed to be earned, whether departments incentivized students, and whether the exam was used as an assessment are compared in table 1. The findings from the two studies are similar and indicate that most programs use the AC exam for assessment, require students to take it, and incentivize them to do well but do not require them to pass the exam to graduate.

Methodology

The data for this study came from an eight-question student survey included with the fall 2016 AC exam. The survey was provided to the students on the back of the exam answer sheet. Exam proctors made the students aware of the optional survey and of the logistics for completing it. The third-party testing service that administered the exam compiled the survey results. The testing service paired the completed student surveys with the students' raw exam scores. Student names and the schools they attended were replaced with non-identifying ID codes. After all identifiers were removed, the survey results paired with exam scores were transferred to the researchers by AIC administration. Of the 649 students who took the exam, 475 (73%) completed the survey. Twenty-eight test takers did not respond to all eight questions of the survey and were not included with the analysis. This paper analyzed 447 completed surveys in their entirety.

Table 1
Survey Comparison of AC Exam Use

Topic	Source	Question	Yes (N)	No (N)
Required	Professional Constructor	Are students required to take (or penalized for not taking) the AC exam?	73% (16)	27% (6)
	ASEE Proceedings	Is it required that all students take the exam?	54% (22)	46% (19)
Minimum Score	Professional Constructor	Do the students in your program need to earn a minimum score on the AC exam to graduate?	26% (6)	74% (17)
	ASEE Proceedings	Are students required to pass [the] exam?	12% (5)	88% (36)
Incentivized	Professional Constructor	Various questions related to paying for [the] exam, incorporation into a grade, and requirement for graduation.	87% (20)	13% (3)
	ASEE Proceedings	Are students incentivized?	51% (21)	49% (20)
Assessment	Professional Constructor	Does your program use the AC exam as a measurement to assess ACCE Student Learning Outcomes?	80% (16)	20% (4)
	ASEE Proceedings	Is your program using the AC exam as a tool for assessment?	68% (28)	32% (13)

Results

The eight questions included with the survey can be found in the first column of table 2. The table provides the responses from all students who completed all eight questions in the survey. The possible responses and the frequency with which they were selected are provided in the second column. The most frequent response is provided in the third column. The questions can be grouped into broad categories where Q1 and Q2 address student preparation, Q3–Q5 address motivation, Q6 addresses exam content, and Q7 and Q8 address AC preparation material.

Student Preparation

The questions Q1 and Q2 addressed student preparation. Question Q1 asked whether the students' institutions provided some kind of structured review session to help them prepare for the AC exam. Nearly half (46%) of the programs did not provide a structured review session. Of those that did, the duration of the session(s) ranged from "less than an hour" (3%) to "longer than 6 hours" (29%). Q2 asked students about how long students prepared for the exam on their own. The most common response was "more than 8 hours" (42%); however, the length of time studying was fairly evenly distributed among the response options. Approximately 21% of the students indicated that they did not study at all or studied less than an hour, 20% studied between 1 and 4 hours, and 17% studied between 5 and 8 hours. Table 3 groups the responses by student pass/fail status. The AIC threshold for passing is a score of 70%. The sample contained 300 students who passed and 147 students who failed. The median response for hours studied by students who passed was between 5 and 8 hours, whereas those who failed studied between 1 and 4 hours. These findings suggest what perhaps was already intuitively known: that students who passed the exam tended to study more than those who did not pass the exam.

Table 2
Frequency of Student Responses

Survey Question	Possible Responses (% Frequency)	Most Frequent Response
Q1) If you participated in a structured AC exam review session(s) that was sponsored by your institution, how many total hours did you participate in the session(s)?	I did not participate in a review session (46%) Less than an hour (3%) 1 to 3 hours (12%) 4 to 6 hours (11%) Longer than 6 hours (29%)	I did not participate in a review session
Q2) How many hours outside of a structured course or review session(s) did you spend studying for the AC exam?	I did not study for the exam (12%) Less than 1 hour (9%) 1 to 4 hours (20%) 5 to 8 hours (17%) More than 8 hours (42%)	More than 8 hours
Q3) How important is it for you personally to do well on the AC exam?	Not important (7%) Slightly important (21%) Important (29%) Very important (43%)	Very important
Q4) How important is your performance on the AC exam to your construction management program?	Not important (7%) Slightly important (17%) Important (30%) Very important (46%)	Very important
Q5) How important is the AC exam to construction companies hiring from your construction management program?	Not important (40%) Slightly important (26%) Important (26%) Very important (8%)	Not important
Q6) How similar were the concepts tested on in this exam to the material taught in your courses?	Not similar (2%) Slightly similar (22%) Similar (51%) Very similar (25%)	Similar
Q7) How useful was the AC Exam Study Guide?	Did not use the Study Guide (15%) Not useful (6%) Slightly useful (27%) Useful (39%) Very useful (14%)	Useful
Q8) How useful were the AC Exam online learning tutorials?	Did not use the online learning tutorials (56%) Not useful (5%) Slightly useful (6%) Useful (16%) Very useful (8%)	Did not use the online learning tutorials

Table 3

Student Responses by Exam Results

Survey Question	Exam Result	Sample Size	Median Response	Standard Deviation	Confidence Interval
Q1) If you participated in a structured AC exam review session(s) that was sponsored by your institution, how many total hours did you participate in the session(s)?	Pass	300	1 to 3 hours	3.4	0.4
	Fail	147	1 to 3 hours	3.6	0.6
Q2) How many hours outside of a structured course or review session(s) did you spend studying for the AC exam?	Pass	300	5 to 8 hours	4.8	0.6
	Fail	147	1 to 4 hours	5.0	0.8
Q3) How important is it for you personally to do well on the AC exam?	Pass	300	Important	0.9	0.1
	Fail	147	Important	1.0	0.2
Q4) How important is your performance on the AC exam to your construction management program?	Pass	300	Very important	0.9	0.1
	Fail	147	Important	1.0	0.2
Q5) How important is the AC exam to construction companies hiring from your construction management program?	Pass	300	Slightly important	1.0	0.1
	Fail	147	Slightly important	1.0	0.2
Q6) How similar were the concepts tested on in this exam to the material taught in your courses?	Pass	300	Similar	0.7	0.1
	Fail	147	Similar	0.8	0.1
Q7) How useful was the AC Exam Study Guide?	Pass	300	Useful	1.2	0.1
	Fail	147	Slightly useful	1.3	0.2
Q8) How useful were the AC Exam online learning tutorials?	Pass	300	Did not use	1.5	0.2
	Fail	147	Did not use	1.4	0.2

Student Motivation

As discussed above, the AC exam may be subject to the difficulties associated with low-stakes testing when the exam results are very important to the department but not important to the test takers. This challenge is particularly acute for the AC exam, given that it is an 8-hour test and unmotivated students may stop giving their best effort before completing it. To further understand student motivation with relation to the exam, the survey asked students three questions related to how important their exam performance was to three key exam stakeholders. Q3, Q4, and Q5 asked how important their performance on the exam was to themselves personally, to their department, and to

the construction industry. Q3 addressed the exam's importance to the students personally. Table 2 shows that the responses were well distributed, with 93% of the responses ranging from "slightly important" to "very important." Only 7% of the students indicated the exam was "not important." Skipping Q4 for the moment, Q5 asked students how important the AC exam was to potential employers. A significantly high 40% of the students responded that potential employers view the exam as "Not important." As discussed above, Burgett's (2017) study asked department heads a similar question about their perception of the industry's support of the exam. The department heads shared the students' perception that the industry does not view the exam as being of high value. The median response from students who passed the exam was the same as the response from those who failed; the passing students viewed industry's support as only "slightly important" to them (table 3). Industry support does not appear to be an effective motivator for students to give their best effort and perform well on the exam.

Exam's Importance to the Department's Program

Question Q4 was skipped earlier, as there are some important findings related to motivation that should be examined separately from how important the exam is to the students and the industry. Q4 asked students how important the AC exam is to their construction management program. The survey found that 76% of the students thought the exam was either "important" or "very important," with the most frequent response being "very important." Students perceived that of the three stakeholders the survey asked about, their department valued the exam as having more importance than did the students themselves or the industry. Regarding the students' perceptions of what their department values, another interesting finding relates to the breakdown of responses between the students who passed and those who failed. Table 3 shows that the median response of students who passed the exam was "very important," whereas students who failed thought their department viewed the exam only as "important." The factors that influence the students' perception of their department is the subject of an ongoing study that will be elaborated on in the future study section of this paper. However, the data suggests that students who pass the exam have a greater perception that their department values the exam in comparison to students who fail the exam. Reinforcing to students the department's commitment to the exam appears to be a successful strategy to improve the exam pass rates.

Similarity of Concepts on the Exam and Taught in Class

Question Q6 asked students how similar the concepts included in the AC exam were to the material taught in their courses. The most common response was "similar" (51%), with 76% responding "similar" or "very similar" (table 2). Only 2% (n=8) thought the exam was "not similar" to what they were taught in their courses. Table 3 provides a standard deviation and confidence interval for the survey questions. Providing this information is unusual with categorical responses, but the information is helpful in understanding the data when used in the proper context. Question Q6 (but similar to all questions Q3–Q8) used four ascending categorical responses following the pattern of "not similar," "slightly similar," "similar," and "very similar." These categorical responses were converted to numerical Likert-scale type responses were "not similar" was 1, "slightly similar" was 2, "similar" was 3, and "very similar" was 4. Using these numerical values, the standard deviation and confidence interval were calculated. The confidence interval provides a +/- range from the sample mean that the population mean falls in given a confidence level. The average Likert-scale response to Q6, concerning the similarity of content, was 3.1 for students who passed the exam and 2.9 for students who failed. These means were not statistically significantly different. The average and confidence interval for students who passed and failed combined (n=447) was 3.0 +/- .1 at 95% confidence. From a practical perspective, this means that students feel the AC exam is "similar" (3.0/4 Likert-Scale) to what they are being taught in their course work.

Usefulness of the AIC-Provided Preparation Materials

The last two questions in the survey (Q7 and Q8) addressed how useful the Exam Study Guide and new Online Learning Tutorials provided by the AIC were to the students. The majority of the students (53%) found the written Study Guide either "useful" or "very useful" (table 2). Approximately 6% found it "not useful," and another 15% did not use it. The new Online Learning Tutorials were offered to the students during the same semester that the survey data was collected. The exam cycle from which the survey data was collected was the first time the online tools was available. Relatively few students took advantage of it compared to the new study guide, resulting in 56% of the respondents indicating that "did not use the online learning tutorials." However, if the students who did not

use it are excluded, the median response was that the tool was "useful" to them, with only 5% indicating that it was "not useful."

Conclusion

This study provided a snapshot of how long students prepare for the AC exam, how they perceive the importance of the exam to primary stakeholders, how similar the exam is to their course work, and how useful the AIC-provided preparation material is. The study grouped the survey responses to see whether there was a difference between the median responses of students who passed the exam and the median responses of those who failed it. The study yielded several interesting conclusions. First, studying has an impact on passing the exam. The median response for students who passed the exam was 5 to 8 hours of study, compared with 1 to 4 hours for those who failed the exam. Burgett (2017) indicated that approximately 80% of the programs that are test sites for the AC exam use it as an assessment in their accreditation. Those programs in particular should reinforce to students that they need to prepare for the exam. Those who do not prepare are more likely to fail than those who do.

The study found that students who passed and students who failed the exam shared the same perception that industry had a relatively low sense of the exam's importance. Both groups also held a similar view that the exam was important to them personally. However, there was a difference in the median response between the two groups related to how important students perceived the exam was to their department. Students who passed the exam tended to perceive that their department valued the exam more highly than did students who failed the exam. This data suggests that when faculty and administration reinforce the importance of the exam, it is taken to heart by a measurable portion of the students. Conversely, if faculty or administration downplays the importance of the exam, that also makes an impression on students and affects their performance negatively.

A potential concern about using the AC exam for accreditation assessment is that faculty are not privy to the exam questions, so their programs' curricula may not align perfectly with the exam content. However, it can be agreed that there is some degree of similarity, as program curriculum, ACCE accreditation, and the AC exam content all come from "industry." The construction industry, of course, is not a homogeneous group, and the thoughts, content, feedback, and priorities will vary from member to member. The significant takeaway that this paper offers to the discussion is that three out of four test takers (76%) thought the exam content was between "similar" and "very similar" to what they were taught in their courses. Given that the AC exam is a national test and every program will have its own concentrations and priorities, this finding appears to reflect high praise from the students and validates its use as an assessment tool. Additional research on this topic is recommended and is discussed in the following section of the paper.

Future Study

This paper provides the preliminary findings of a study that collected nearly 500 surveys from the fall 2016 AC exam cycle. The data presented was aggregated by pass/fail status, and responses between the two groups were compared. A much deeper statistical analysis is currently ongoing. This ongoing research, which will be presented in a future publication, provides an analysis based on individual exam scores, which allows for a much more granular analysis of the data. Average responses by students, statistically significant differences, and multicollinearity among the factors are being explored. While not complete, the preliminary findings from the more in-depth future study confirm the conclusions of this paper drawn from the aggregated data sets. Specifically, the findings showed that studying for the exam and students' perceptions of their departments' support had a measurable impact on student exam scores.

Q6 of the student survey asked students how similar the exam content was to what they were taught in their courses. The majority of students responded that the material was between "similar" and "very similar" of the ascending categorical responses provided. Although this data is useful, the survey question was very general and asked about the similarity of the *whole* exam and *all* their coursework. Given that the exam is used as an assessment tool for program accreditation, a worthy future study could collect data on students' perspectives on course work similarity by specific student learning outcomes. The AIC/CCC could use this data as a quality control measure to ensure that

questions about particular subject areas are not significantly different from what is taught in programs across the country.

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