A Recommendation to Implement a Quality Assurance/Quality Control Topics Course

Jacob W. Stapp
Construction Management B.S
California Polytechnic State University
San Luis Obispo, California

The purpose of this report is to recommend and gauge student interest/need for the addition of a Quality Assurance/Quality Control topics course to the Construction Management curriculum. Both Quality Assurance and Quality Control are vital for all construction projects, and without proper implementation there is no way to ensure high quality results. In an industry that demands high quality projects, it is important that our department prepares our students to be well-rounded in all aspects of construction. This will enable our graduates to enter the workforce in full stride, contributing efficiently from the start. Our University’s motto is “Learn by Doing,” therefore, we shall prepare our graduates to excel in all areas, especially out in the field. This project reveals the need for an increased understanding of QA/QC practices amongst Construction Management graduates. A department-wide survey of the Construction Management students at Cal Poly provides this recommendation with a discovery component. This includes the newfound knowledge of high levels of student interest in enhancing their knowledge of QA/QC before graduation. Throughout this report, research and discovery shall translate into the implementation of a tech elective course that Cal Poly Students can choose to enroll in.

Keywords: Quality Assurance, Quality Control, Curriculum, Cal Poly, Construction Management

Introduction

Quality Assurance and Quality Control are both tools which hold great value to the successful completion of all construction projects. Without these two elements of professional practice in the construction industry, there is no ensuring that projects are built and delivered as intended. It is our job as builders, and especially entry level project engineers, to have a full understanding of the benefits, practices and execution of these vital tools when carrying out our day-to-day tasks on the jobsite. Without proper implementation, there will be repeated work, delayed schedules, cost impacts, safety hazards, and, perhaps most importantly, an unhappy owner.

According to the U.S Air Force Instruction (AFI) 63-501, Quality Assurance (QA) is defined as, “A planned and systematic pattern of actions necessary to provide confidence that adequate technical requirements are established; products conform to established technical requirements; and satisfactory performance is achieved.” Quality control (QC) is defined as, “The measurement of a process or product by an automated process, operator, or other person, with comparison to requirements and action to resolve variation from a standard.” Simply put, quality control verifies standards set by quality assurance. Some examples of quality assurance in construction include the following; establishing standards for designers, material, and suppliers, ensuring satisfaction of legal and building code requirements, as well as testing and inspection procedures. Therefore, quality control is the actual testing of materials, inspection of work completed, signing of drawings and documents, and verifying all work is kept consistent with QA standards.

As an intern level project engineer for a general contractor, I was asked to perform QA/QC work from the start of my work out in the field. I found myself fascinated by the practices, programs, and procedures, and I couldn’t wait to learn more. These same learning experience should be had by all construction management students before graduation. The purpose of this paper is to contextualize the need for a QA/QC course in Cal Poly’s Construction Management curriculum, and to assess student interest in taking such a course.
Methodology

An assessment of student need and interest was required in order to conclude whether or not the addition of a QA/QC course to the Construction Management curriculum was beneficial. While it is readily apparent that QA/QC is important for successful construction work, this report will attempt to discover whether students are interested in the course and if they believe it is necessary for their education. I set out to provide supporting evidence that Cal Poly Construction Management students wanted a QA/QC course and would benefit from its existence. As well as supporting student interest, my data must support the idea that a student educated in QA/QC would make for a more well-rounded and knowledgeable project engineer out in the workforce. In order to gather such data I decided to obtain information, opinions and data from the students and faculty, an industry professional, and other construction management programs in the state.

Student Survey

In order to assess the interest and need for a QA/QC class amongst Cal Poly Construction Management (CM) students, it was apparent that a survey needed to be conducted. This survey was provided online and made accessible program-wide to ensure diverse and un-skewed results. The introduction of the survey provided students with a description of its objective, as well as the definition of quality assurance and quality control. In order to effectively organize my results, some background information was required of the respondents. This included questions to determine grade level, number of internships, and experience with QA/QC. While the survey was sent to the entire department, it was gauged towards 3rd years and above. This is due to the fact that the majority of young CM students have not yet made their way through much of the curriculum nor completed internships in the industry yet. As a result, their opinions would not be as valid compared to older students in our department.

Next, I needed to gauge the respondent’s opinions of the importance of QA/QC on construction projects, as well as the importance of being knowledgeable on this topic before graduation. In order to do so I asked them questions about their exposure to QA/QC during internships, how important they believe QA/QC work is to construction projects, whether or not they have ever felt confused or unsure when asked about QA/QC, and how important they feel it is for CM students to have proper education and exposure on the topic.

Cal Poly Construction Management students are given the freedom of taking tech elective courses of their choosing. The CM department gives students a list of options of which they can decide between based on their personal preferences. Based on this, I tailored some of my questions to reflect the student’s interest of the general topic, as well as the option for a QA/QC course. Students were asked to rank their interest level of the course and identify which components of QA/QC they are the most interested in learning about.

Results

For years, students and faculty of the Construction Management department have aided seniors in gathering new knowledge for their senior project via surveys and questionnaires. These surveys are sent out to the departments’ entire student body. While participation is optional, it is highly beneficial to both parties to opt-in. As students mature through the program they begin to realize how vital their responses are, increasing their likelihood to participate. My survey received 30 responses in total. Of the 30 respondents, 90% of them were third years and above, satisfying my initiative of receiving responses from older students. Of these 27 upperclassmen, all but two (92%) of them reported to having at least one internship. These two results gave me confidence that the respondents would provide accurate, informed, and revealing responses in correlation to the Cal Poly CM students’ actual experiences in the classroom and on the jobsite.

Survey respondents were then asked how often they have been asked to perform QA/QC work on these said internships. Of the students who had participated in an internship, 70% reported to have been asked to perform QA/QC work at some point throughout the duration of their internship. An astounding 100% of survey-takers reported that they believe QA/QC is an important practice on any given jobsite. Directly following this question, respondents were asked if they ever felt confused or unsure when asked about QA/QC work. An alarming 85% of them answered yes, providing strong results for one of the most important questions in the survey. These results
provide a solid indicator that CM students will more than likely need to perform QA/QC work even during internships, requiring a base knowledge of the subject beforehand in order to feel comfortable and succeed.

*Have you ever felt confused or unsure when asked about QA/QC?*

![Figure 1: Student Survey Results](image)

When survey respondents were asked about their general interest level of QA/QC in construction projects, the weighted average was a 3.58 out of 5 (1 being lowest interest and 5 being highest interest). This average was paired with a 3.27 out of 5 average for their interest level in taking a 2 unit QA/QC tech elective. While the interest level was not as high as I had anticipated it would be, there is still a strong indication that there is an interest level among our department’s students. In fact, just over 96% of respondents stated that education and exposure to QA/QC practices was important for Construction Management students. Paired with this question, an average score of 2.5/5 was given by respondents when asked how well the CM department has provided education on QA/QC. These results show that students believe a QA/QC course is both necessary and beneficial to their education. All survey results are included in Appendix A.

*How important do you feel it is for CM students to have education and exposure to QA/QC practices?*

![Figure 2: Student Survey Results](image)
Interview with an Industry Professional

Scott Harrison, QA/QC director for Swinerton Builders, Sacramento Division, volunteered to aid my research with his personal knowledge, experiences, and suggestions in the implementation of a QA/QC course. We formed a dialogue via email through the course of my research, resulting in Mr. Harrison taking part in a written interview I tailored specifically for him. The objective of this interview was to gain perspective from an industry professional who specializes in the area of QA/QC work. This interview took place after my student-wide survey results were gathered and contains the following questions:

- Construction Management graduates understanding of QA/QC: (Rate 1-5, 1: Lowest 5: Highest)
- Which QA/QC practices do you feel Construction Management students should have a better understanding of? Please List
- Do you believe Construction Management departments should provide a course focused on QA/QC? Yes or No
- In such a class, which computer programs should be introduced and taught to students to better prepare them for QA/QC work?
- Are you aware of any textbooks, workshops, tutorials or other educating material that could be beneficial to such a class?
- Do you feel a QA/QC course should be an optional elective or a required course?
- Can you give your opinion of what topics should be emphasized in a QA/QC course to better prepare graduates for work after school?

These questions were paired with a comments or suggestions segment for Scott to elaborate on any of the questions, the proposed class, or just QA/QC in general. All results from the interview are included in Appendix A.

Results

Mr. Harrison’s responses were extremely insightful, providing a solid backing for my research. He was very pleased to help out and loved the idea of implementing such a course. Scott stated that he believed that Construction Management departments should provide a course focused on Quality Assurance/Quality Control and that this course should be a requirement in the curriculum. He stated, “Quality Management is the way of the future and will be a requirement on all construction projects in the near future.” While Mr. Harrison stated that he hadn’t noticed much difference between graduates of different schools, he did rank Construction Management graduates understanding of QA/QC overall a 1.5 out of 5 (1: Lowest, 5: Highest). This was an alarming response coming from an industry professional, strengthening the need for the Cal Poly Construction Management department to begin implementing such a course. The QA/QC practices Mr. Harrison believes should be stressed in such a course include: The value of policies, processes and procedures, lean management for construction/Six Sigma, 3 phases of Quality Management (Army Corps of Engineers), as well as codes and standards. In terms of education material, Mr. Harrison said graduates should strengthen their understanding of AutoDesk BIM 360 field, as well as flowchart software. Some good texts he recommends for this course are Quality is Free by Philip Crosby, and The Toyota Way by Jeffrey Liker. Overall, I am thankful for Scott Harrison’s participation and aid in strengthening my research, providing recommendations and evaluations based on his years of industry experience.

Other CM Programs

While proposing a QA/QC class for the Cal Poly Construction Management curriculum, I understood that researching what other Construction Management programs offered in terms of QA/QC education would be greatly beneficial. I decided to take a look at some of our neighboring California CM departments, including those at Sacramento State, Chico State, University of Southern California, San Diego State University, and Stanford. After a close look at each program’s curriculum, I determined that they are consistent with what Cal Poly offers in terms of QA/QC. While the topic is discussed and touched upon in certain laboratories and lectures, there is no class that
focuses on QA/QC entirely. Sacramento State comes close in offering a course called “Properties of Construction Materials,” which covers material testing concepts and procedures, but this class does not cover the entirety of QA/QC practices as I am proposing.

New Knowledge

Completion of my student survey and industry interview translated into a great amount of new knowledge. These two methods of discovery documented a real need and interest for a QA/QC course in the Cal Poly CM curriculum. Aside from the information provided in the results segment of this report, some additional knowledge was gathered to accommodate the possibility of a future addition of this course. Scott Harrison recommended that the following topics should be emphasized in a QA/QC course to better prepare graduates for work after school:

- Understanding of Plan, Do, Check, Act processes
- CAPA (Corrective Action Preventative Action)
- The value of quality management, “Understanding that Quality is free and rework is expensive.”

Student respondents to my survey also ranked their interest level in a variety of QA/QC practices. As seen in the graph below, field inspections were ranked the highest and should be highly considered when developing this class.

Which of the following QA/QC activities for you find the most appealing? (Select all that apply)

![Figure 3: Student Survey Results](image)

Deliverables

This senior project considered and examined the possibility of implementing a Quality Assurance/Quality Control topics course to the Construction Management Curriculum at Cal Poly. While this project was mainly focused on both the student and professional viewpoints of such a class, the research and discovery provides a foundation to future students or faculty to build upon. An individual may look to take the next step in designing and developing a structured class to be implemented into the Construction Management Curriculum. Deliverables such as a course syllabus, schedule, goals, lesson plans, and required texts would be a great start to putting this class into action. The research from both Cal Poly CM students and an industry professional forms the conclusion that there is in fact both a desire and a need for a higher level of education in Quality Assurance and Quality Control within the Construction Management department at Cal Poly.
Lessons Learned

When working to complete a project of this magnitude, a review of the process can reveal many learning opportunities for the future. The first aspect of the project that comes to mind is my survey results. While the results of the survey were strong, and the responses adequate, a larger pool of respondents would have been highly beneficial. This is due to the fact that with more respondents comes stronger and more accurate results. Looking back, I could have been much more proactive in motivating my peers of the Construction Management department to participate in my survey by spreading the word and reaching out to friends.

Due to the fact that the CM department has a broad curriculum with a magnitude of construction related topics to cover, I learned that the best way to integrate a new class such as this was to recommend it as a 2-unit tech elective. By doing so, the class does not become a requirement but an option for students to enroll in. This gives the CM faculty the chance to monitor its effectiveness and enrollment rates. This option also eliminates burdens such as cost and scheduling for the department since it will only require existing resources and a qualified professor. Unlike required courses in a college curriculum that need approval by the California State Board of Education and even the American Council for Construction Education, a topics course would simply require the approval of the Construction Management Curriculum Committee.

Application

From the results and data this project has produced, a strong backing has been developed to recommend the implementation of a Quality Assurance/Quality Control topics course here at Cal Poly. Due to the fact that an interest and need for such a course has been made apparent, the ball now rests in the court of the Construction Management faculty. With the information provided here they will be able to come together and discuss the feasibility of adding such a course to the curriculum. Here they will be able to develop a precise course description and goals for the course catalogue. The department may opt to add this class onto the load of a part-time lecturer or full time professor. If budget or schedule is seen to be an issue in the implementation of this course, a qualified student faculty member may be brought on board to teach the course for just $12 an hour. This option has been utilized in a few of the department’s tech electives, such as BIM. While this qualified student would take lead of the majority of lectures, there would still be supervision by a professor to ensure the class is operating at the level it should. The chosen supervisor would of course be compensated as well for his or her hours and part of a negotiated salary. The process of building a course such as this would only require an estimated 3 months, which could be done over the less hectic period of summer quarter. Thus, making the Quality Assurance/Quality Control topics course available as soon as fall 2019.

Future Research

Quality assurance and quality control will continue to be a cornerstone in successful construction projects for the foreseeable future. Based on my research of the student interest and need in such a course, a faculty member or future senior may choose to develop the course curriculum. Thus, providing the Construction Management department hard deliverables and an addition to the curriculum as I have suggested. If this implementation does show to be a clear benefit for Cal Poly Construction Management graduates as they embark on their new entry level positions in the workforce, other colleges and institutions may look to adopt such a course in their curriculum. For most colleges and universities, the overall mission statement remains somewhat related, as an intention to develop and educate students for the workforce. This could then lead to the next level of research, taking a pool of universities results to the California State Board of Education for large-scale implementation. By implementing a Quality Assurance/Quality Control topics course here at Cal Poly, we will indeed hold true to our mission statement of producing graduates of whom are qualified and ready to contribute to both the construction industry and society as a whole.
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Appendix A