# Implementing a Quality Improvement Project on Improving AED Access on a College Campus: An Educational Technique

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**Context:** Athletic training educators are tasked with designing experiences that meet the standards set forth by the Commission on Accreditation of Athletic Training Education standards and foster student engagement and learning, including the new standards on quality improvement (QI) and quality assurance, communication, and advocacy. As newer curricular content standards, many educators are exploring ways to engage students in these processes in meaningful, engaging ways.

**Objective:** Describe an educational experience for students to engage in a real-time QI project aimed to improve campus access to automated external defibrillators (AEDs).

**Background:** This project focused on QI in AED access and time-to-shock for out-of-hospital survival rates in sudden cardiac arrest. AEDs should be available and administered within 2 to 3 minutes of collapse to improve out-of-hospital sudden cardiac arrest survival rates.

**Description:** Using the Plan, Do, Study, Act cycle for QI, students engaged in a structured real-life QI project as part of coursework and in-class activities. As a multiyear, continuous project various cohorts got to learn and build off previously completed work to improve campus access to AEDs.

Advantage(s): This project can be completed in a didactic or clinical setting. Various Commission on Accreditation of Athletic Training Education standards were taught and assessed while providing students with the real-life experience and hands on experiences grounded in the social constructivism learning theory.

**Conclusion(s):** Creating real-life learning experiences for students to engage in a QI project centered around campus access for AEDs improves student learning of QI, emergency preparedness, and advocacy through real-life, problem-based activities and highlights the impact athletic trainers and athletic training students can have on campus safety plans.

Key Words: Plan, Do, Study, Act (PDSA) cycle, social constructivism, advocacy

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#### **KEY POINTS**

- Athletic training students must be educated on the process of emergency action planning/preparedness, advocacy, and quality improvement.
- The use of a real-life, hands-on activity promotes student learning and engagement, as supported by the social constructivism learning theory.
- Students who complete this project engage in a meaningful activity that promotes learning and enhances emergency preparedness on a college campus.

### INTRODUCTION

Innovation in educating athletic training students for clinical practice that recognizes the collaborative nature of health care and incorporates a commitment to quality improvement prepares future practitioners to lead initiatives such as "community safety" and "emergency preparedness." Continuous quality improvement focused on patient experience to achieve optimal outcomes for the patients and communities we serve is a priority in health care.<sup>1</sup> Quality improvement (QI) is defined as the "systematic and continuous actions that result in measurable improvement in health care services and in the health status of targeted patient groups."<sup>2</sup> Educating students to value and become proficient in the process of ongoing QI will allow them to meet this important role in practice.<sup>3</sup> Within the expectation for entry-level competence, the Commission on Accreditation of Athletic Training Education (CAATE) 2020 Standard 63 set the expectations that athletic training programs prepare graduates to meet the core competency of "quality improvement."4

The QI principles and models developed in manufacturing business are readily applied to health care practice settings.<sup>5</sup> The Plan, Do, Study, Act (PDSA) cycle is an iterative design that applies hypothesis testing and critical inductive and deductive thinking to solve real-world problems. Typically, this cycle is implemented by a team that gains knowledge and experience as they complete the steps of the PDSA cycle. When applied within a learning environment, completing 1 or more iterations of the PDSA cycle allows learning objectives to be met within the context of solving real-world problems as a member of a team. Creating focused learning activities for students to work together in a structured and real-world goal-directed activity is an innovative way to demonstrate compliance with CAATE Standard 59 that articulates an expectation that graduates of athletic training programs "communicate effectively and appropriately with clients/patients, family members, coaches, administrators, other health care professionals, consumers, payors, policy makers, and others."<sup>4</sup> Development of this essential core competency can be explicitly met in the classroom when students take an active and collaborative role in their learning.

Wyatt and Gilliland use the yin yang symbol to highlight the differences and synergies between teaching and learning.<sup>6</sup> Creating real-world instructional activities requires an educator to

define intended learner outcomes within a situated learning context. Social constructivism learning theory recognizes that learning is facilitated through active engagement with other learners.<sup>7</sup> This theory aligns with the goals for implementing a QI project into a course and guided this active learning instructional activity. This model highlights how this balance between teaching and learning can be achieved. Social constructivism theory was applied in 2 specific ways. First, the instructional activity allowed learners to build on prior knowledge and experiences to create new knowledge that had meaning to them. The meaningfulness of their learning was facilitated by their active engagement in a real-life environment. Second, as members of health care teams, it is essential for students to learn how to collaborate with other professionals. Through participation within their group, students develop knowledge through interactions with other learners. The new knowledge achieved is the outcome of the perspectives, experiences, and knowledge that each member brings to the group. Balance between the vin and yang occurs when there is alignment between "what students need to learn" and "what the teacher does to prepare for learning."6 The description below details how 1 faculty member prepared for students learning within the context of learning objectives aligned with several CAATE standards. Table 1 depicts how a variety of instructional activities and assessments of student learning were progressed along Bloom's taxonomy to achieve the highest level of learning.<sup>8</sup> The objective of this manuscript is to demonstrate how to develop and implement an on-going QI class project to evaluate and improve automated external defibrillator (AED) accessibility and maintenance on a college campus.

### DESCRIPTION

This project elected to focus on the topic of AEDs. This topic was selected due to the prevalence of sudden cardiac arrest, a condition that can occur due to a traumatic event, psychosocial stress, or a cardiac etiology that causes an individual's heart to stop beating. Sudden cardiac arrest is a leading cause of death in the United States, impacting as many as 300 000 individuals every year.<sup>9</sup> The importance of access to AEDs is evidenced in the literature, indicating that survival decreases approximately 10% every minute that defibrillation is delayed.<sup>10</sup>

Specifically, we chose to focus on the availability and preparedness of 1 institution to have and maintain AEDs. This project recognizes the role of athletic trainers to "develop, implement, and revise policies that pertain to prevention, preparedness, and response to medical emergencies and other critical incidents," as detailed in CAATE Standard 92.

Although the focus of this project has remained consistent, the scope has changed. This initially began as a student-led capstone project and has evolved into a class project that has continued and changed over multiple years. Below, we will summarize the various components and provide an overview of how the project was completed and evolved over time.

Student Leaning			ne Cognitive Process [	Dimension		
Standard 56: Advocc Standard 59: Comm consumers, payors Standard 63: Use sy Standard 92: Develo incidents <sup>4</sup>	ate for the health nu unicate effectively s, policy makers, ar stems of quality as p, implement, and	eeds of clients, patients, co and appropriately with clier of others <sup>4</sup> surance and quality improv revise policies that pertain	ommunities, and popul ats/patients, family me vement to enhance clie to prevention, prepare	ations <sup>4</sup> mbers, coaches, admin ent/patient care <sup>4</sup> edness, and response to	istrators, and other h	ealthcare professionals, es and other critical
What Level Is Each of the Following?	1. Remember (Recognize, Recall)	2. Understand (Interpret, Exemplify, Explain)	3. Apply (Execute, Implement)	<ol> <li>A. Analyze (Differentiate, Attribute)</li> </ol>	5. Evaluate (Check, Critique)	6. Create (Generate, Plan, Produce)
Teaching/learning methods		Discussion between students and key interested parties <i>Standards 56 and 59</i> Discussion facilitated by faculty to identify best practices for emergency action planning and AED access <i>Standard 92</i>	Applied knowledge to develop the plan to perform AED access assessment <i>Standards 63 and 92</i>	Analyze their findings relative to best practice Standards 63 and 92	Onsite assessment of number, location, and integrity of AED devices <i>Standard 92</i> Onsite assessment of "time-to-shock," both planned and unplanned <i>Standard 92</i>	Compiled findings in a report and presented to key interested parties <i>Standards 56, 59, and 63 Standards 56, 59, and 63</i> Changing, revising, and adapting the report to reflect their audience (ie, Department of Safety and Security, Campus Health, and Academic Administration) <i>Standards 56 and 59</i>
Assessment of leaming		Describe how their work fit into the process of QA and QI Standard 63 Ongoing formative assessment and feedback by faculty to students through large group discussion Standards 56, 59, and 63	Open- and closed-ended examination questions <i>Standard 92</i>	Initial findings with areas of concerns highlighted relative to best practice <i>Standards 63 and 92</i>	Reflection on how students implemented the assessment process and how to improve in subsequent trials Standard 92	Final presentation of comprehensive recommendations and revisions to policies <i>Standards 56 and 59</i>

Abbreviations: AED, automated external defibrillators; QA, quality assurance; QI, quality improvement.

## **OVERVIEW OF PROJECT COMPONENTS**

### **Unplanned Time Trails**

In this instructor-led, planned activity, a student is tasked with finding the closest AED without prior prompting or identification. To set the scene, the instructor should simply stop what they are doing and say "I've just suffered a sudden cardiac arrest. You \*point to a student\* go find the closest AED, take a picture of it with your phone and come back." Collapse to the floor for added drama. This works best when students are not expecting it. The instructor starts the timer on their phone or stopwatch to time and records the time it takes for the student to return. After they return, the instructor should lead a discussion on the response time, appropriate response time for sudden cardiac arrest and initiation of an emergency action plan. While the student is gone, the students in the classroom are usually discussing among themselves where the closest AED is. The student who left can describe where they found the AED, how they knew its location, and any barriers, challenges, or aides that they encountered (maps, signage, previous knowledge, etc). This can be performed as part of a didactic course or at a clinical rotation. At our institution, this activity was integrated within a didactic course and led the discussion around emergency action planning. Anecdotally, we found that most students did not know where the closest AED was, even though they walked past it every day. Some discussion/ debrief prompts or questions are included in Table 2.

### Identification of Key Interested Parties

This activity can be run as a guided class discussion or small group work that is initiated by a "think-pair-share." Variations of the size of "teams" or groups are influenced by the size of the class and individual cohort/group dynamics. The key with this activity was to ensure that all students participated and were engaged. In this activity, students were asked to individually brainstorm a list of key interested parties who would have influence or decision-making capabilities for AED placement, maintenance, and upkeep on the general college campus. Students then paired with a partner to review and compare their lists. Then, in small groups, or as a class, pairs shared their ideas and key interested parties. The students were challenged to identify the actual person, not just their role or position at our specific institution, and find their contact information and/ or campus location. Discussion surrounded why that person would be a key interested party and what role they may play. This activity/discussion is a precursor activity for the follow-up/ advocacy piece that follows any of the activities. We do, however, recommend running the "unplanned time trial" activity first before initiating a real discussion about AED placement/ location or advocacy efforts as to not influence the students. Some discussion prompts or questions are included in Table 2. A follow-up activity could include having the students interview (or ask via email etc) the identified personnel to see if their assumptions are true. If you do not have the students engage in that follow-up activity, it is helpful if you have the answers to these questions ahead of time.

# INITIAL AED LOCATION EVALUATION

This activity was a guided in-class discussion or small group work that was initiated by a "think-pair-share." Similar to the identification of key interested parties, variations of the size of "teams" or groups are influenced by class or cohort size and dynamics. The goal is for all students to participate. Students were provided a publicly available map that identified the building locations for all AEDs on campus. Class discussion surrounded the potential rationale behind locations chosen, perceived "gaps" in AED accessibility, and awareness of AED locations. Specific guiding questions can be found in Table 2.

# AED LOCATION AND EQUIPMENT ASSESSMENTS

This active learning experience involved students, in pairs or small teams, who identified all AED locations on campus and created a plan to review and evaluate. In our case, we used a publicly available map to identify the building locations of the AEDs and grouped the students into teams to evaluate 2 to 3 AEDs. Depending on the size of the cohort/student group, size of the campus, and number of AEDs, this could look slightly different at another institution. Students may need to complete components of this on their own time if in-class time activity time does not allow for completion or adequate assessment. Teams of students went to each identified building, found the AED, and noted the specific location. The groups were also instructed to document any physical barriers identified, including locked doors, signage, or other access issues (eg, interactions with people), with as much detail as possible. The teams of students also checked each AED and noted the model, general impression of the condition, battery information, pad information, and expirations as well as details regarding any other equipment stored in the kit, including scissors, razors, etc. We provided the students with a form or Excel sheet to fill in the information to guide their evaluation that also included an open-ended area for them to document any notes or impressions. These data were then aggregated to show the findings for all university AEDs. As a class discussion, general themes, overall impressions, and any concerning findings were synthesized (Table 2). Data, including any noted areas of improvement, were then provided to the appropriate individuals identified previously. Other activities could include the students writing a structured memo or report detailing their findings and recommendations.

# PLANNED TIME TRIALS

Planned time trials involved the students preselecting locations based on their prior knowledge or previous AED location and equipment assessments. We had students identify "areas served" by specific AEDs to assess for response/"time-to-shock." These locations included the furthest point served by various AEDs, high traffic areas, or other perceived "gaps" in AED accessibility. Once starting locations were identified, in small groups or teams, our students completed 3 jogging/running and 3 brisk walking trials going from the starting point to the identified AED, taking a picture with their phone to simulate opening the case and removing the machine, and coming back to the identified point. The time to complete each was then averaged. If you have various students running and/or walking, times should be averaged. Consideration should also be made for buildings with multiple floors and trials with stairs versus an elevator, multiple routes of entry, or other previously identified barriers. The point of this exercise is to provide those tasked with AED placement to have data demonstrating areas that may be farther than the recommended guidelines, even when the AED locations are known.

# Table 2. Potential Discussion Questions to Guide Small Group or In-Class Discussions or Activity Debriefs for Each Activity<sup>a</sup>

Unplanned Time Trials	Was tde time of x witdin tde previously discussed acceptable range for AED retrieval?		
	How many knew where tde closest AED was?		
	How did you find tde AED or know where to go?		
	Did you encounter any barriers or challenges? If so, what helped you overcome tdem?		
	How could someone who was activating tde Emergency Action Plan ask for tde AED more efficiently to reduce some confusion or time? (Tell tde person		
	getting the AED exactly where to look, give clear instructions, etc.)		
	Discuss tde need for emergency preparedness and awareness of available supplies at all times as an AT; provide examples including traveling witd a team to an away event, airports, dining witd tde team, and so on where an emergency may arise, and an AT should always know where tde closest		
	AED is.		
Identification of Key Interested Parties	Who would be a key interested party at this institution?		
	Why would they be considered an interested party? What role might they play?		
	Who would you think is responsible for deciding AED placement?		
	Are there any rules or regulations that would govern the AED placement that you can think of?		
	Who do you think is responsible for checking/assessing the AEDs on campus? How often do you think they are checked? How do you think this may be documented?		
	Who do you think is responsible for ordering new supplies?		
	Whose budget do you think those supplies come from?		
Initial AED Location Evaluation	What are your initial impressions after looking at this map?		
	What are some of the strengths or areas of improvement?		
	What can you tell (or not tell) from this map? Probe: Can you discern where in the building these are located? What barriers may you encounter when trying to access these AEDs? (Specific concerns include swipe access to buildings, specific security settings for buildings, multiple		
	entrances to buildings, etc.)		
	What key interested party do you think should be involved in this discussion? Do you think there are additional data they may need?		
AED Location and Equipment	What were your overall findings?		
Assessments	What are some of the strengths or areas of improvement?		
	Why do you think you have found what you did? Do you have potential solutions or improvements?		
	What key interested party do you think should be involved in this discussion? Do you think there are additional data they may need?		
	Who do you think is responsible for checking/assessing the AEDs on campus?		
	How often do you think they are checked? How do you think this may be documented?		
	Who do you think is responsible for ordering new supplies?		
	Whose budget do you think those supplies come from?		
Planned Time Trials	What were your overall findings?		
	what are some of the strengths or areas of improvement?		
	solutions or improvements?		
	What key interested party do you think should be involved in this discussion?		
	Do you think there are additional data they may need?		

Abbreviations: AED, automated external defibrillators; AT, athletic trainer.

<sup>a</sup> Classroom or preceptor educators should modify based on their findings and learner needs.

Data from any of these activities, alone or in combination, should be provided to the responsible parties for initiating change at your institution. This could start with your direct supervisor and identifying the other key interested parties. At our institution, the students' findings were brought to various entities including student health, safety, and security as well as facilities and maintenance. By having students engage in the process, they learn valuable communication and advocacy skills in a real-life scenario while also practicing emergency preparedness and initiating and evaluating emergency action plans in simulated scenarios.

# Table 3. Description of the Implementation of Techniques and Activities Over Multiple Years Within a Single College Campus, Including Outcomes

Plan	Do	Study	Act
Form a team to identify problems to be studied and plan your actions for the cycle; identify exactly what your objectives are, what you want to achieve, and what data will be collected	Carry out the change or test, observing where any problems lie and start collecting data for analysis	Act on the data that you have collected to implement or plan for the next cycle	Review, discuss, and reflect on the data collected through the lens of the anticipated outcome(s)
	<b>AY 2019–202 Throu</b> Small Group Ca	<b>gh AY 2020–2021</b> pstone Project	
This small group capstone project was initially discussed and needed support from all parties before it could be developed. Identification of key interested parties. The initial project included discussion between students and key interested parties (department administrators, public safety officials, and student health representatives) about the plans and intent of the project. This was an important step to ensure buy-in, cooperation, and understanding.	<ol> <li>Initial AED location evaluation.</li> <li>Students initially reviewed where the public-facing AEDs were on campus and which buildings they were intended to serve, as not every building on campus has a dedicated AED. The students discovered there were 10 AEDS located around the approximately 100-acre campus, serving about 50 total buildings. One location was not accessible at the time due to its location within Student Health Services and COVID-19 restrictions regarding access.</li> <li>AED Location and Equipment Assessments.</li> <li>The students took inventory of the AEDs and equipment as described above. Two of the 9 AEDs examined were recalled by the FDA. Five of the 9 AEDs' batteries were dead or dying (as identified by a beeping). All of the pads, except for 1 set, were expired in all AEDs. There were also inconsistencies noticed with the other equipment, including availability of gloves, scissors, pocket masks, and spare pads.</li> <li>Planned Time Trials</li> <li>During an initial walk-through, the students also timed themselves walking briskly and running from various points on campus to the closest AED and back to get the "time-to-shock." Most locations chosen were within the recommended 2 to 3 minutes. It was discovered during this initial "Do" phase that there were issues regarding location, visibility, and upkeep. Issues were noticed with the AEDs. At this time, the extended and the students is noticed with the AEDs. At this time, the</li> </ol>	Initial findings with respect to accessing the AEDs revealed that ID swipe access was required for all buildings, and hours of operation for those buildings varied. Further barriers to AED access included AEDs being stored behind desks and out of view, other items in front of the AED blocking view, additional security clearance being required for those in student housing buildings, and varying locations of the AEDs within the buildings.	The students involved in this project summarized their findings and concerns. Along with a faculty advisor, they presented these findings and recommendations to all invested parties. Completing the last phase of the PDSA cycle aligns with CAATE Standard 56 advocate for the health needs of clients, patients, communities, and populations."

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#### Table 3. Continued

Plan	Do	Study	Act		
AY 2022–2023 Class Project Integrated into Emergency Care During the Modules Covering Emergency Action Planning and Cardiac Event.					
Social constructivist theory guided the development of the instructional activity detailed here. A modified PDSA cycle was applied to this instruction activity to introduce continuing quality improvement principles within the context of a role of athletic trainers. Instructor planning centered around the activity as well as integration into a curriculum and coursework.	<ol> <li>Unplanned Time Trial. During this unannounced "time-to-shock" event, the chosen student returned after about 10 minutes and said they could not locate an AED. The student then stated, "You're dead—sorry." During the class discussion, many other students in the class were unaware where the closest AED was. The students documented these findings, including the subsequent class discussion around AED locations, signage, and maps.</li> <li>Key Interested Parties</li> <li>Initial AED Location Evaluation There were still only 10 AEDs on campus, and areas of need were, once again, identified.</li> <li>AED Location and Equipment Assessments</li> <li>The 2 recalled AEDs were replaced, all pads were up to date, and all AEDs had a second set of pads. All other equipment, including scissors, face shields, etc, were present in all AED kits.</li> </ol>	Students came together to discuss and synthesize their findings. A class discussion was held, guided by the description and discussion questions above, regarding the findings, including demonstrating the improvements from the previous year's assessment. The class discussed how this was part of a larger, on-going QI project and how their findings could be used to improve campus safety. All findings from the initial "unannounced time-to- shock" activity, AED checks, and subsequent discussions were synthesized for the students to present feedback and recommendations to the relevant parties in writing.	After these findings were provided to the relevant parties, the faculty member was notified that many changes would occur based on the results and recommendations. The appropriate parties reviewed, adjusted, and created policies and procedures that would ensure the upkeep and maintenance of the AEDs on campus. They also purchased 12 new AEDs for campus, 8 that were placed in fixed locations identified by the students as higher traffic areas with limited AED access and 4 to be placed in patrol cars that can quickly respond to other emergencies on campus. Additional signage was also created and was set to be installed. One individual specifically credited the student project and data provided as the rational that allowed them to implement the improvements.		
AY 2023–2024 Class Project Integrated Into Emergency Care During the Modules Covering Emergency Action Planning and Cardiac Events					
The class project was continued, grounded within the social constructivist theory, to identify any improvements made	1. <b>Unplanned Time Trial</b> This activity was once again completed in class. This time, the student returned in under 5 minutes, although they expressed trouble finding the	As a class, a discussion, as guided by the previously described points and data, was synthesized. The class discussed the signage that had not been	All data and suggestions were provided to the relevant and appropriate individuals in writing.		

installed and how that may and continued areas of AED at first but did end up be beneficial. Students advancement. Instructor locating one. planning centered 2. Initial AED Location also identified other around the activity as Evaluation improvements that could well as integration into a be made. curriculum and coursework.

Abbreviations: AED, automated external defibrillators; CAATE, Commission on Accreditation of Athletic Training Education; COVID-19, coronavirus disease 2019; FDA, Food and Drug Administration; PDSA, Plan, Do, Study, Act; QI, quality improvement.

Table 3 provides a summary of how we integrated the various activities into a multiyear project grounded in the PDSA cycle of QI. Specific findings and results are also discussed from this project. Classroom and/or preceptor educators can modify the activities needed to fit their campus or learner needs.

#### **ADVANTAGES**

Several advantages and positive outcomes have been identified. This project raises awareness that athletic trainers and athletic training students can have a big impact on general campus safety plans. Unlike many other learning activities, even active

learning activities such as simulations or problem-based learning scenarios, this project puts the students and the project forward facing to others in the university community rather than staying within the confines of the classroom or athletics.<sup>11</sup> Awareness of athletic trainers' expertise in creating, evaluating, and refining emergency protocols is increased by contact and influence with various individuals and departments across campus, not just isolated to athletes. Additionally, students can engage in relevant and meaningful real-life learning experiences, which facilitates learning.<sup>7,11–13</sup> There was also an improved maintenance plan and increased number of AEDs on our campus as a direct result of our students' in-class activity, thereby increasing our campus's emergency preparedness. The students were able to see specific outcomes related to advocacy, QI, and recognition of athletic trainers' skillsets in emergency preparedness and emergency action planning. Compared with traditional lecture or theoretical exploration/discussion about the topic with no concrete examples or real-life application, this project brings realness to the learning.<sup>11–13</sup> Because students create personal lived experiences, it can be more impactful than other pedagogy, such as lecture or case studies around emergency planning.<sup>11–13</sup> This project can also be threaded through didactic curricula or clinical experiences, which models how continuous OI can be implemented in a variety of locations or experiences. This single project, unlike other learning activities such as traditional lecture-based pedagogy,<sup>13</sup> case scenarios, or simulations, also uses multiple teaching, learning, and assessment activities (see Table 1), which scaffolds learning and increases complexity.<sup>6,8</sup> By creating and implementing a very intentional experience with real-life problems, implications, and interactions with interested parties, this guided learning experience gets students to work together in teams to identify how they will approach addressing their real-life problem put before them.<sup>6,7,12</sup> This reallife context provided the meaning to motivate students to solve the problem before them.

### CONCLUSIONS

Developing a focused, continuous QI plan aligns with CAATE Standards, engages athletic training students in contextually rich learning activities, and creates a sustaining process for ensuring campus safety with respect to AEDs. Use of the PDSA cycle allowed exploration of the problem through several iterations as action plans were implemented and assessed and facilitated student's learning. With each iteration of the PDSA cycle, students were able to expand their knowledge, refine their assessment, and elevate the goals for implementation. The outcomes across the past 4 years that the program has implemented the PDSA are evidence that the aim of bringing its users closer to the established goals has been met.

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