Using Continuous Quality Improvement in Competency-Based Education Programs

A Quick Guide for Practitioners and Program Leaders

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Introduction

A continuous quality improvement (CQI) process is a tool for competency-based education (CBE) program leaders to ensure that their programs are meeting their goals of serving students in an efficient, effective, and equitable manner. To that end, this guide provides a framework, along with recommendations and tips, for CQI in CBE programs. This guide may help you answer questions such as the following:

- How do we know when a change is an improvement?
- What works, for whom, under what conditions?

The American Institutes for Research (AIR), which hosts the National Research Collaborative on Competency-Based Education and Learning, produced this guide.

WHO IS THIS GUIDE FOR?

Our resources are for anyone interested in CBE or educational program evaluation for continuous improvement. This tool particularly may be best for program leaders, staff, and instructors with CBE programs in at least their second year of program implementation. For those earlier in the planning or implementation stages, this tool may be helpful for planning purposes, but it is likely most useful after a complete cycle or academic year, which allows you to identify opportunities for improvement.

The Plan-Do-Study-Act Cycle

The Plan-Do-Study-Act (PDSA) cycle is a credible and simple model for CQI that provides an evaluative framework for taking systemic improvement actions. Because it is simple to understand and use, the PDSA cycle is applicable to a wide range of real problems that CBE practitioners experience every day. Before beginning, practitioners should ensure that they identify the challenge they are trying to solve, at least one potential root cause of that challenge, and an improvement goal to overcome the challenge.

The individual phases of the PDSA cycle in this guide have been broken down into three sections to allow CBE practitioners to dive deeper if they choose to implement this model when working to solve a programmatic challenge:

- **Explanation**: An overview of each step in the PDSA cycle, with clarification as to why the phase is crucial in the CBE evaluation process
- **Example**: An illustration of a problem that an institution may face to give practitioners a sense of how the phase might occur in the real world
- **Prompts**: Targeted questions that will help facilitate each phase in the process

Guide to the Plan-Do-Study-Act Cycle

Phase 0: Root-Cause Analysis

PDSA assumes that you have clarity about the problem you are trying to solve. Often, however, the symptoms will be clearer than the real problem causing those symptoms. A root-cause analysis can be a valuable first step that will help identify the underlying cause of the problem and provide useful information that you can use in the planning stage of the PDSA cycle. It can help you target a specific issue to tackle in the PDSA cycle; identify what data you may already have that will be useful; or highlight areas where you need to collect new, baseline data.

A root-cause analysis both distinguishes symptoms from problems and supports prioritization of problems to address through CQI and a PDSA cycle. To conduct a root-cause analysis, consider the following questions:

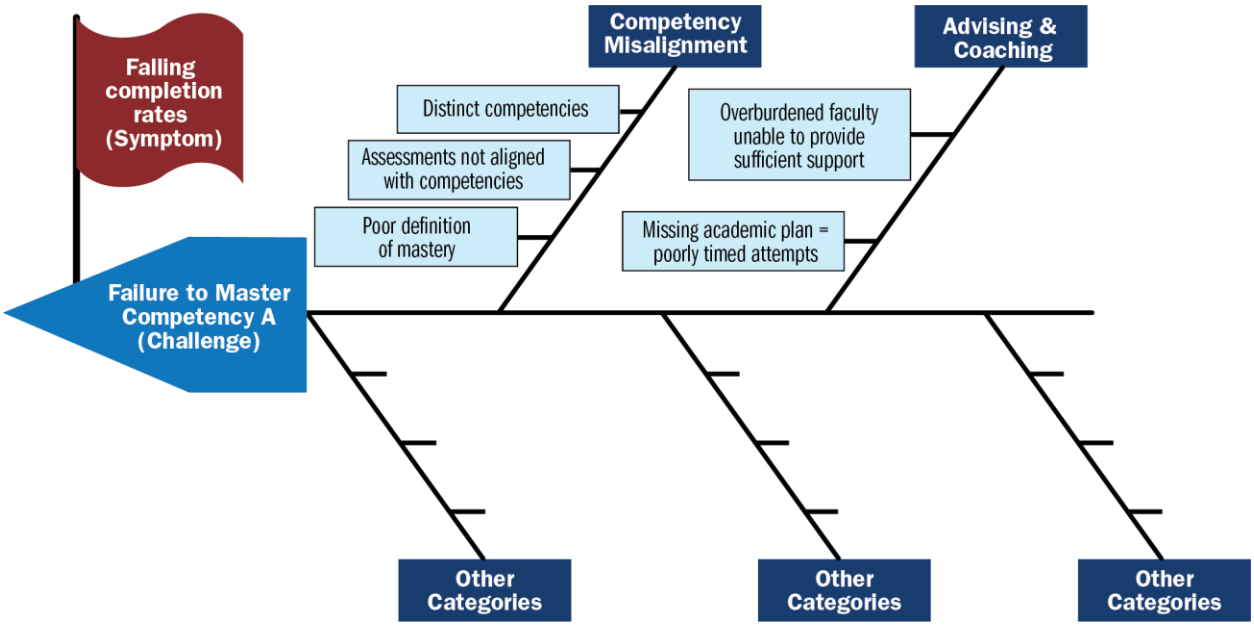
1. What is the visible challenge you think you are encountering and what may be the causes of that challenge? What data do you have that indicate this is a challenge?
2. Why might this be happening? What are some possible explanations, or root causes, for that identified challenge? (To get to these root causes, simply keep asking the question "why?" until you have drilled down deeper and deeper and called out all the root causes you can identify for your symptom.)
3. What are the broad categories of these potential root causes? Which of these categories are areas that you can impact or control?
4. Which root cause will you prioritize for the PDSA cycle, and what measurable goal can you establish to address this root cause?

Exhibit 1 is an example of a "fishbone" diagram, a simple visual that can help identify potential root causes of a challenge that you are experiencing. We share and build on this worked example throughout this guide.

In this example, CBE program leaders noticed falling completion rates, a symptom of the broader challenge. Through further discussions and data exploration, the team identified the broader challenge: a failure to master a particular competency. They then identified potential root causes of this challenge, noted in the dark gray boxes in Exhibit 1, including poorly aligned competencies and challenges with advising and coaching. They continued to drill down, focusing on the question "why?" to identify more specific root causes. Ultimately, these fictitious program leaders decided to focus on the issue of overburdened faculty unable to provide sufficient support because this was an area that they did not spend much time on during the initial design of the program, assuming the roles and responsibilities of faculty would mirror their traditional program counterparts.

Appendix C provides a full-size, blank fishbone diagram for you to use for your own planning purposes.

Exhibit 1. Fishbone Diagram Example



Phase 1: Plan

Explanation

Phase 0 is a preliminary step focused on identifying the challenge and its associated root cause. With the root case identified, program leaders can now turn to the full PDSA cycle. The planning phase of the PDSA cycle involves finding answers to four basic questions: what, when, who, and how. The why should already have been established after identifying a challenge and setting an improvement goal.

- **What**. *"We know the problem, but what do we do about it?"* Determine the change you will make to achieve your improvement goal and how to measure it effectively. Brainstorming is a good way to come up with potential solutions, but there is no need to reinvent the wheel. Consulting peer colleagues/programs/institutions, reviewing academic literature on the subject, and connecting with experts in the subject matter can help identify vetted solutions or best practices that already exist. (Refer to the appendices for additional information. Appendix A includes a detailed audience analysis, and Appendix B has links to numerous online resources.) Be sure to break your solutions into smaller, individual steps.
- **When**. *"When do we want each step of solution to be completed? When are we evaluating the impact of the solution?"* Determine when the change will happen and when the results will be measured. Make sure to have start and end dates for each step of the process.

- **Who**. *"Who needs to be involved in each step of the process?"* Designate who is involved or responsible at each step of the change process. Will those individuals need additional access, new tools, or special training to help with their role?
- **How**. *"How will we measure the changes from the solution?"* Identify relevant measures that will help monitor progress of the solution. Are there existing measures that can be used in the evaluation or do new measures need to be developed? Are the data from those measures readily accessible? Data that helped identify the symptom of the root cause may not be best suited to evaluate the solution because symptoms and causes may be several steps removed (as the fishbone diagram illustrates).

When creating a plan, it can be useful to develop a visual representation that includes the overall start and end dates for the improvement goal, a list of tasks assigned to specific people, and key milestones. Several different types of planning tools can be used when beginning the PDSA cycle, including premade PDSA templates, collaborative online tools, and Gantt charts. Gantt charts are displays that provide an overview of the entire evaluation and include a time frame for each task (Exhibit 2).

Example

The Gantt chart in Exhibit 2 is an example of one way to plan for implementation. Referring to the example addressed in the root-cause analysis (e.g., Exhibit 1), the team identified the root cause as overburdened faculty who were filling too many roles and therefore unable to provide the necessary academic support to students experiencing challenges with mastering a competency. As such, the fictitious program leaders identified disaggregating and simplifying the role of faculty, an observed practice across CBE programs, as their solution moving forward.

The plan should include what each individual task is, when each task will be completed, who is assigned to each task, and how associated outcomes will be measured. There also are specific tasks to monitor progress and determine whether the improvement goal has been successfully completed. Exhibit 2 illustrates a visual example of what this could look like, but it does not cover all the steps that would be necessary to implement this change.

Exhibit 2. Gantt Chart Example

Task name	Assigned to	Q3			Q4			Q1			Q2		
		July	August	September	October	November	December	January	February	March	April	May	June
Planning													
Determine and define new faculty roles and responsibilities	KM, EM	■	■	■									
Develop a budget for hiring new staff and implementation	MH, JM		■	■									
Assign implementation task leads	KP, MH			■									
Implementation													
Hire new faculty as needed	EM			■	■								
Provide faculty training based on the new roles	VP, RR				■	■	■						
Assign students to the new advisors and coaches	IR, AK						■						
Monitoring													
Survey students and faculty on the new model	JM, KP							■	■				
Track student competencies and monitor results	MH, GB								■	■	■	■	
Debrief meeting	All												■

Prompts

- What is your ultimate improvement goal?
- Do you have clear start and end dates for the overall improvement plan? Do you have clear start and end dates for each task/activity?
- Have you identified a team to participate in the execution of your improvement plan? Have you scheduled time to train your team and professional staff?
- Does each step in your process specifically indicate a person or office responsible for completing it?
- Do you have a method for monitoring and measuring progress?

Phase 2: Do

Explanation

A well-defined, detailed plan goes a long way in aiding the execution of an evaluation. However, your plan may not be able to identify or address all the potential barriers that you might face. This phase of the PDSA cycle focuses on three things: (a) implementing the change, (b) collecting the data needed for the evaluation, and (c) troubleshooting any challenges that may arise in the process. It is important to identify the source of the data needed for your evaluation. Are the data something your department has readily available or will you need to collaborate with your institution's institutional research or information technology office to get access to the data? It also is vital to limit data collection to what gets at the subject of the evaluation. Although tempting, excess data could complicate your analysis during the "Study" phase of the PDSA process.

Some challenges during implementation may stem from a lack of capacity, whether it is a short-term issue caused by competing interests or priorities or a long-term issue because a skill or resource (e.g., data collection, analysis) is underdeveloped. Other challenges arise because of a lack of buy-in among leadership or key implementation partners (the staff or faculty implementing the change or collecting the data). The solutions to these challenges will vary, but potential mitigations are as follows: include partners from the onset, establish a common understanding of the problem and solution, and work with partners to establish clearly defined roles throughout the process. These steps could increase buy-in among partners and add skill sets, resources, and capacity that you may not have on your core team. Engaging a champion—a key senior-level stakeholder who visibly supports the work—also may increase engagement and support from others.

Example

Collecting Data

Data collection to support your evaluation is the key part of the "do" phase. Continuing with the example of the disaggregated faculty model implementation, data to collect and observe might include the following:

- Completion rates of the competency in question
- Student engagement with faculty in different roles, as measured by learning management system usage
- Student surveys about their experience with the new faculty roles

Addressing Challenges

Exhibit 3 shares examples of challenges that you may encounter as you implement your intervention, along with possible solutions, with an eye toward the roles that different team members can play in solving problems.

Exhibit 3. Examples of Implementation Challenges

Challenge	Possible solution
Incomplete buy-in among high-level partners	• Develop a project charter at the outset of the activity that is signed by all key stakeholders and approved by the champion (e.g., president, provost, or vice president) and refer to it as needed.
Emergent priorities delay or displace plan	• Leverage champion investment in activity. • Build sufficient slack in the project schedule to mitigate risk. • Distribute and regularly review the Gantt chart with the team.
Problems with follow-through on the ground	• Articulate a compelling value proposition for the effort. • Have visible champion involvement throughout implementation. • Acknowledge and reward staff at the implementation level.
Failure to explicitly plan for measurement	• Involve institutional research staff, information technology staff, and analysts at the outset of the project.
Gaps in data or analytic capacity	• Develop the analysis plan before the intervention begins, to ensure that all necessary components are accessible.

Prompts

- How are you collecting the data you need for the improvement plan? Do you already have access to it or will you need support from someone outside your team?
- Have you identified which data are most vital to the improvement plan? How have you prioritized the data you intend to collect?
- From your initial planning phase, are there anticipated or likely challenges you could face? What steps could you take to mitigate the impact of those challenges? If they arise, what is your plan of action?
- How will you keep members of the team involved in the improvement plan engaged, especially if they are not involved in data collection? How will you ensure continued progress and build opportunities for refinement of your plan into the process?

Phase 3: Study

Explanation

Once you have started implementing the change, the next critical step is to study whether it is solving the originally identified problem. This "Study"—or evaluation—phase focuses on understanding what happened through your intervention or program activities. The general

questions to answer in this phase are similar to the following: "What did the intervention do?" and "Did the intervention address the root cause?" Of several considerations to keep in mind, two are the most important: How to study the results of your activities, and what you should be measuring to understand the impact.

The "How": The method you choose to evaluate the impact of your change should tie to the goals of your evaluation and what you are trying to understand. This guide focuses on using quantitative data, such as student retention rates or course pass rates, but you may find that qualitative or mixed-methods evaluations that incorporate data from surveys, interviews, or observations, are useful or appropriate, given the focus of your evaluation.

- **Descriptive and inferential statistics**. Statistics, such as counts and percentages, that summarize and describe data, along with simple hypothesis tests, can lend some rigor to your assessment of progress.
  - *What they can do*. Understanding the results of most CQI work does not require complex statistical analyses. In many cases, simple descriptive statistics can be very helpful to identify whether you are moving the needle in the right direction. Moving beyond descriptive statistics, simple hypothesis tests, such as *t*-tests, can provide insight as to whether any differences you notice in the descriptive statistics are meaningful.
  - *What they cannot do*. Descriptive statistics cannot establish causal relationships. For example, an increase in retention after a change in advising policy may be caused by that policy change, but it also may result from any number of other influences in the campus environment.
  - *When to use*. Descriptive statistics are a good starting point for any evaluation; they can provide a big picture understanding of whether your intervention moved the needle and begin to tell you how meaningful this movement or difference may be.
  - *Example*. Compare the mean competency mastery rate before and after implementing the disaggregated faculty model, using simple percentages. Then apply *t*-tests to understand whether the difference in those rates is statistically significant.
- **Quasi-experimental designs**. In education, it can be difficult, if not impossible, to establish control groups to support a traditional experimental design. Either students do not randomly assign themselves to an intervention in the case that it would be something they would choose, such as online versus on-the-ground courses, or we as educators hesitate to withhold a potentially useful intervention to someone who might benefit from it. A quasi-experimental design allows us to use statistical techniques to simulate the conditions of a traditional experiment.

- *What they can do*. Quasi-experimental designs get you closer to understanding whether a causal relationship exists between your intervention and outcomes, by mediating some of the bias associated with students self-selecting into a particular program or course.
- *What they cannot do*. Although quasi-experimental designs support a stronger understanding of whether there may be a causal relationship, they still cannot prove that your intervention caused the change in outcomes you observed.
- *When to use*. Quasi-experimental designs are especially useful when you need to make a stronger case linking an intervention to an observed change in outcomes, but it requires a significantly greater investment in terms of time and data analysis expertise. If you have the time, expertise on staff, and sufficient data, the results from these analyses will be stronger.
- Examples of quasi-experimental approaches (This is not an all-encompassing list, but it highlights two examples commonly used in education evaluations.):
  - *Propensity score matching*. This approach simulates random assignment to treatment and comparison groups by developing a statistical model that predicts a student's likelihood of selecting into a treatment (e.g., a CBE course or program). This allows you to identify a group of students who did not select into that activity that is as similar as possible to those who did. You can then compare outcomes across the two groups and be more confident that the difference in outcomes is caused by the activity rather than important differences between the two student groups. Following the disaggregated faculty model implementation example, this approach would work at an institution with multiple CBE programs, if the disaggregated model were, for example, piloted in just one program. This approach also is useful for cases where students self-select into a particular kind of program, such as when there are CBE and traditional versions of the same program available.
  - *Interrupted time series*. This approach involves following a group of students for a longer time period during which a program or activity was implemented, comparing outcomes before and after the implementation point—the "interruption." This allows for a simulated experimental condition by essentially observing students before and after they were exposed to a new intervention, controlling for influencing factors, such as a preexisting trend in outcomes. (For example, in a *t*-test approach, if scores had already been trending upward, we may attribute the change in outcomes to the intervention without accounting for this.) This approach also is useful in cases where institutions "flip the switch" on a program or course, converting it from a traditional model to a CBE model. This approach, similar to

propensity score matching, can help you make a strong case for the existence of a relationship between a treatment and an outcome.

- **Experimental designs**. An experimental design, or a randomized controlled trial (RCT), is an approach where participants in a study are randomly assigned to treatment and control groups, thereby allowing researchers to make claims about the causality of an intervention.
  - *What they can do*. RCTs allow researchers to establish a causal relationship between an intervention and resulting student outcomes, which can build a much stronger case for the intervention or program in question.
  - *What they cannot do*. Although RCTs often are the "gold standard" of research design, they are difficult to achieve in educational settings. First, as discussed earlier, students rarely receive random assignment to a program or intervention. When it is possible to randomly assign students, programs should weigh the pros and cons of withholding a potentially valuable intervention with the ability to make the case for causal relationships between an intervention and changes in student outcomes.
  - *When to use*. RCTs are appropriate when students can be randomly assigned to an intervention, and when program leaders are comfortable withholding that intervention from some students at first to make a stronger case about causality.
  - *Example*. In the example of implementing the disaggregated faculty model, an RCT would likely not be the most appropriate approach because the logistics of partially implementing the disaggregated model, such that some students would continue with "business as usual," would likely be too difficult to justify the approach. A more feasible example would be a program piloting a new intervention where students receive nudges through the learning management system for specific advising actions. In that case, the program leaders could choose to randomly assign some students to receive the nudges, whereas others in a control group continue with business as usual, and then compare outcomes between the two groups.

Prompts

- What are we trying to say with this study? Between which variables do we think there may be a relationship?
- Who is the audience for these findings, and what level of rigor will they expect/be ready to interpret?
- What resources are available right now (e.g., time, expertise, data)?
- Do the current conditions allow for a true experimental design? If so, what are the pros and cons of withholding treatment from some students?

Phase 4: Act

Explanation

Once you finish the Study phase, it is important to intentionally move to broader action based on what you learned by answering two questions: Who needs to see these results? and What's next? As you review your findings, consider whether the changes you implemented resolved the root cause.

If you think your root cause was addressed, you can consider implementing or scaling the change more broadly. As you do this, it is important to consider two things:

- Are you sure the results you see are based on the change you made?
  - As referenced earlier, descriptive statistics often are a helpful starting point, but they do not always account for selection bias. If you happened to test the change only with your "accelerating" students, for instance, the results you see may be attributable to something else about that group rather than the intervention. That does not mean you should not implement it, but it is important to keep that in mind and continue to monitor any issues.
  - If you used a quasi-experimental or experimental design, it is more likely that your change is the cause of your improved results.
- Do you think this change will affect everyone similarly? Is there any reason to test it with different types of students or faculty first?

In either case, sharing the results with relevant audiences is an important step, including sharing with those making the change, any decision makers (deans, provosts) who may appreciate understanding how you are improving the program, and colleagues who supported the evaluation work (such as institutional research or institutional effectiveness colleagues). Depending on the focus of the change, faculty, coaches, and even students might appreciate knowing the results as well. Finally, for external audiences, you can publish your results in an outlet such as the *Journal of CBE*.[1]

If the root cause was not addressed, your team still likely learned something this time; consider documenting that learning to inform adjustments. It also is worth remembering that some challenges may take time to fully resolve, even after addressing the cause. Then, consider whether to start a new PDSA cycle with a new challenge or restart the cycle on this challenge. Some key things to keep in mind as you do this are as follows:

[1] https://www.wgu.edu/about/competency-based-education/journal.html

- CQI is a human process, and it can challenge structures, dynamics, and established processes. It is worth devoting time to build a cohesive team to tackle these challenges.
- CQI, especially in CBE programs, likely spans multiple roles and is not someone's primary responsibility. When possible, align CQI with ongoing efforts and activities.
- Especially in CBE, CQI requires collaboration and cross-boundary collaboration. When feasible, it is worth reducing friction by honoring any campus norms that you are not directly challenging, developing incentives for participation, and capitalizing on existing structures.

Example

Once the evaluation is complete, program leaders responsible for implementing the disaggregated faculty model can use those results to determine whether they think the root cause has been addressed. If it has, they may decide to continue implementing the disaggregated model and perhaps expand it to other programs at their institution. As part of that expansion, it may be important to share the results of this study with other audiences, especially faculty who may want to know that something will work before they invest energy in making the change. If the root cause has not been addressed, then they may first consider tweaking the implementation of the disaggregated faculty model or identify another root cause using the fishbone diagram and begin the PDSA cycle again.

Prompts

As you wrap up your study, it may be useful to ask your team to consider the following questions:

- What have we learned?
- What is our next step?
- Has the root cause been resolved?
- [If a control group or pilot approach was used and a root cause was addressed] How, and when, do we implement this or scale this officially?
- If the root cause has been resolved, what is the next problem/symptom to address?
- If the root cause has not been resolved, what did we learn? How should we change our plan to increase our chances of success in the next cycle?
- Who do we need to share this information with internally? Do we have strong evidence that would be helpful to colleagues or decision makers about our program?
- What did we learn about the process of CQI, and how should we change our approach?

Appendix A. Communications

A well-done evaluation offers little value if the findings and their implications are not communicated. Despite all the buy-in and shared ownership you cultivated during this process, those involved may not have the time, or interest, to read a full report. Even executive summaries, although very effective at conveying a brief narrative, can sometimes "bury the lead." Identifying the appropriate audience and their priorities makes communicating easier by establishing clear targets, and using data visualizations to quickly convey information makes communication more effective.

Audience analysis is a key step in sharing the results of your evaluation or continuous improvement efforts. Knowing your audience allows you to understand what kinds of messages will be best received by an audience, or what kinds of data they will more likely to connect with. It also can make the presentation more engaging and interesting to the audience, which will increase the likelihood of them taking action as a result.[2] Key steps and questions to consider in an audience analysis are as follows:

1. Identify potential audiences:
    a. Who will be affected by the issue at hand?
    b. Who has control over it?
2. Identify the priority audience:
    a. Who will be affected?
    b. What is the size of the audience?
    c. How important is it that audience behavior changes as a result of the new knowledge generated by the improvement process??
    d. What do we need to support changes in audience behavior?
    e. What external influences or stakeholders are at play?
3. Understand the priority audience:
    a. What is the audience's background? How familiar are they with your intervention, your program, or CBE in general?
    b. What experiences do audience members bring to the table?
4. Identify accelerators, barriers, and potential audience questions:
    a. What habits may audience members have?
    b. May they be fearful of or resistant to change? Why?

[2] For more information on communicating your message in CBE, see the Competency-Based Education Network's (C-BEN's) Strategic Storytelling Toolkit.

5. Tailor your message accordingly.
   a. How can you frame your key findings to best appeal to your audience?
   b. What data can you include, and what are the most effective ways to visually present the data given your audience's background?[3]

Exhibit A1 provides prompts and example answers to these questions, to help you clearly lay out the process. A blank version of this worksheet is in Appendix C.

Exhibit A1. Audience Analysis

Steps 1 and 2: Identify potential and priority audiences audiences			
What do you want to communicate?			
Who are the intended audiences?	**Why is this relevant to this audience? Why would they care?**	**Does this audience have control or influence over the issue? If yes, how?**	**Are there external stakeholders who may influence this audience? Who and how?**
Audience A: Office of the provost	• Data support student retention and their desire to receive credit for prior experience. • Data address priorities from a recent student survey, including learning flexibility.	Yes; the office of the provost provides approval for and budget recommendation for academic initiatives.	Private grant funder who is supporting another academic initiative. Need to see this as alignment, not competition.
Subgroups? If so list them here. Provost	• Data can support further expansion of existing programs.	Yes; the provost is the executive decision maker regarding financial allocations for program expansion.	State/systems that are influencing/mandating policy regarding academic programs.
Subgroups? If so list them here. Deans	• Data can increase buy-in and engagement from these key stakeholders.	Yes; they have influence over the adoption or expansion of academic programs. They often draft budget requests and need to use data supporting their request.	Peer institutions and overall academic trends leaning toward alternative academic programs may influence this audience.
Audience B: Academic departments	• Data help track progress to performance targets, such as student persistence, progression, and completion rate.	Yes; buy-in from academic departments is critical for successful on-the-ground implementation.	This audience may be influenced by external colleagues who may be adapting different types of programs.
Subgroups? If so list them here. Department chairs, faculty	• Can use data to improve individual student outcomes and provide supports.	Yes; they have influence and partake in the decision-making process even if they are not final decision makers.	

Add additional rows if needed

[3] For more information on data visualization, see the following:
- The Data Visualization Catalogue (Ribecca, n.d.) contains a repository of different visualization types and styles, as well as a host of additional resources on visualizations.
- The Data Visualization Checklist (Evergreen & Emery, 2016) contains information on stylizing and formatting visuals.

Step 3: Understand your priority audience		
List audience or subgroup from Step 1: Department chairs, faculty		
Audience background and characteristics	**What is the desired behavior change for this audience/ subgroup?**	**How likely is it that this audience/ subgroup will demonstrate the desired behavior change?**
A highly educated and influential group	• To provide budget space for implementation. • To integrate into the next academic calendar.	• This audience is less likely to demonstrate desired behavior change and is more inclined to uphold the status quo.
Step 4: Identify accelerators, barriers, and potential audience questions		
Potential challenges or barriers	**Potential accelerators**	**Anticipated questions**
Competing priorities or programs, resistance to change	• Some members of this group will likely have a deep understanding of data and data use.	• Why should we spend money on a new initiative? • How do we ensure program quality meets our academic standards?
Step 5: Tailor your message accordingly		
Key points to communicate to address challenges, leverage accelerators, and respond to anticipated questions		
It will be critical to gain buy-in from this audience because they tend to be the most resistant to change. This audience also is most likely to engage with data. Particularly, data that can demonstrate impact on cohort/subpopulation and individual-level student outcomes will help gain the desired behavior change.		

Appendix B. Additional Resources

Designing and launching a CBE program is a task that requires focus, attention to detail, and coordination to accomplish, but those efforts are just as important when it comes to refining and improving the program. A consistent and thorough CQI process helps address any issues that occur after the initial launch and can help the program adjust to changing needs from students, faculty, the institution, or the field. The following are some additional resources on program evaluation and some of the methodologies mentioned in this guide:

General resources

- AIR has modularized webinars about measurement in CBE and CQI processes.
- The University of Wisconsin–Madison's Division of Extension has a webpage with many resources dedicated to program evaluation.

Examples of methodologies

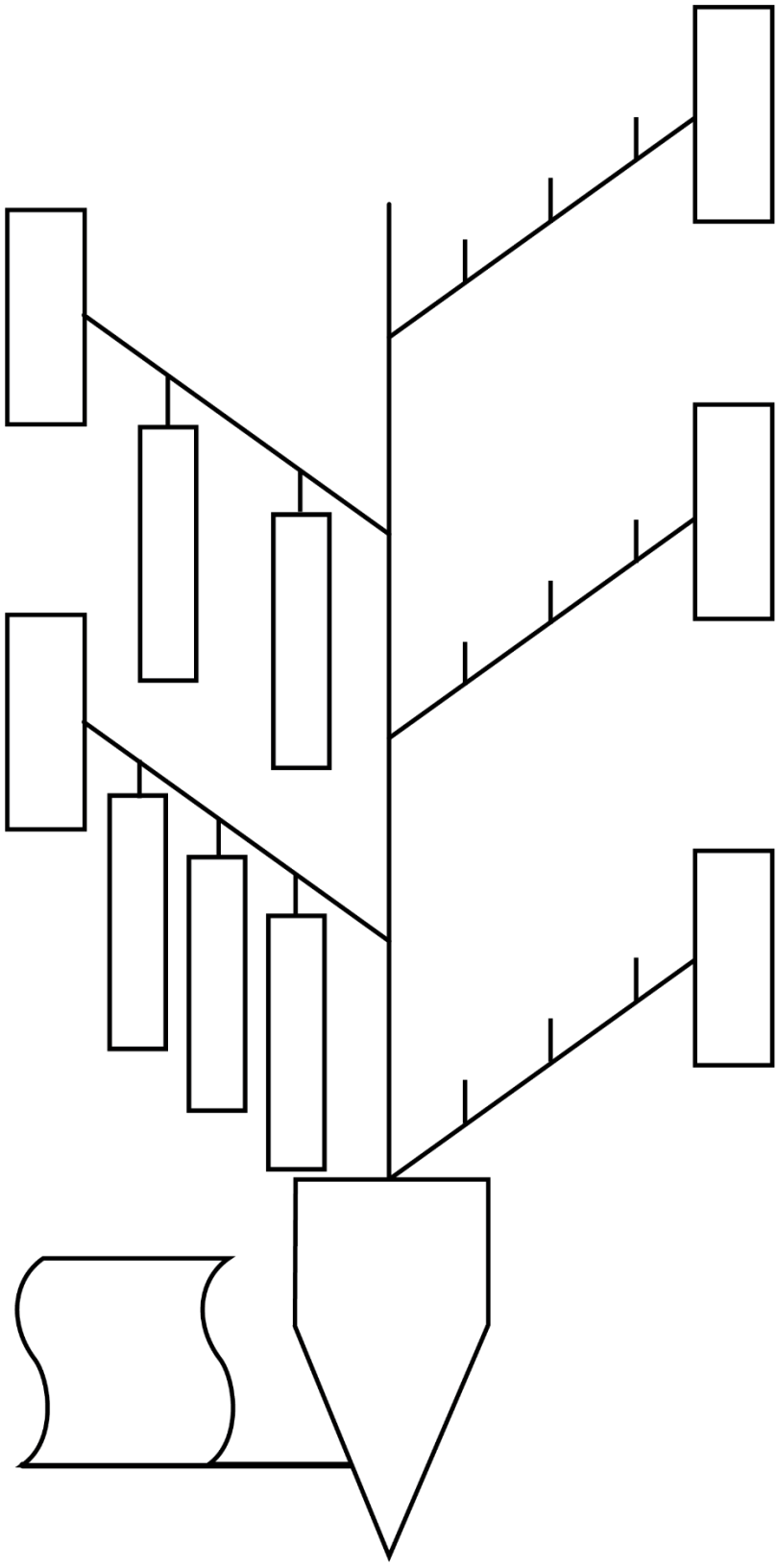
- A Rivers and Sebesta (2017) article demonstrates using descriptive statistics in a study.
- Orange and Hodges (2015) use propensity score matching in their quasi-experimental study.
- AIR (2017) conducted a study using an interrupted time series approach in the methodology.

Resources for planning or expanding CBE programs

- C-BEN's Quality Framework and associated *User's Guide*
- *A Leader's Guide to Competency-Based Education* (book; introduction available for download; otherwise requires purchase)
- C-BEN maintains a searchable resource library of practitioner resources.
- AIR maintains a complementary resource database focused on research related to CBE, particularly for those interested in performing literature reviews.
- AIR's research and tools about CBE student outcomes, including a metrics framework, a tool for articulating and measuring the goals of CBE programs and a paper containing findings about student outcomes in CBE.

Appendix C. Blank Worksheets

Sheet 1. Fishbone Diagram



Sheet 2. Audience Analysis

Step 1: Identify potential audiences			
What do you want to communicate?			
Who are the intended audiences?	**Why is this relevant to this audience? Why would they care?**	**Does this audience have control or influence over the issue? If yes, how?**	**Are there external stakeholders who may influence this audience? Who and how?**
Audience A:			
Subgroups? If so list them here.			
Subgroups? If so list them here.			
Audience B:			
Subgroups? If so list them here.			

Step 3: Understand your priority audience		
List audience or subgroup from Step 1:		
Audience background and characteristics	**What is the desired behavior change for this audience/subgroup?**	**How likely is it that this audience/ subgroup will demonstrate the desired behavior change?**

Step 4: Identify accelerators, barriers, and potential audience questions		
Potential challenges or barriers	**Potential accelerators**	**Anticipated questions**
Step 5: Tailor your message accordingly		
Key points to communicate to address challenges, leverage accelerators, and respond to anticipated questions		

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