2025

# Evidence of Learning

## A humanizing, meaningful and balanced approach

The XQ Math Badging framework and learning principles are designed to ensure that every student who attempts a badge will ultimately earn it. This approach replaces traditional systems of math instruction and assessment with a student-centered model that promotes growth, voice, and agency throughout the experience.

When implemented thoughtfully and with rigor, XQ Math Badging works to humanize mathematics learning experiences by offering a flexible vehicle for students to demonstrate their understanding of the knowledge and skills outlined by each badge's Content and Practice Expectations (CPEs).

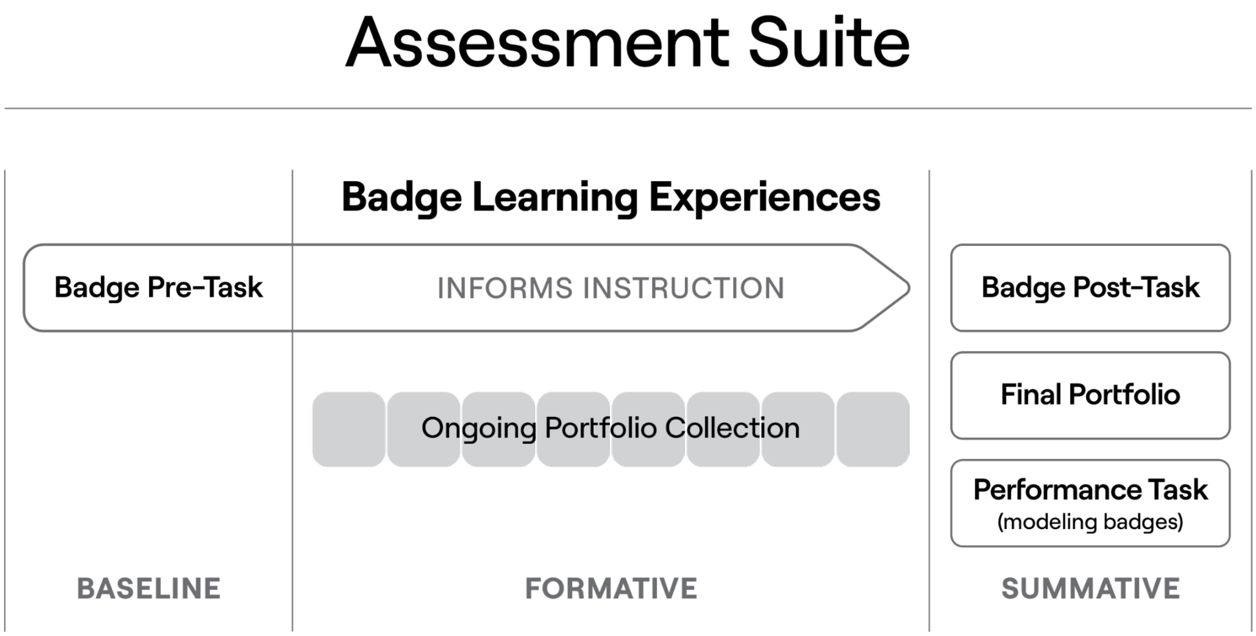
Each badge framework describes the overarching goals, CPEs, and cognitive complexity levels targeted by each badge. In addition, the Math Badging Resource Zone (MBRZ) contains instruction and evaluation resources, including guidance on developing portfolios of evidence with students, sample performance tasks (for modeling badges), and pre-/post-badge tasks to be administered at the beginning and end of the badge. Annotated student work is provided for select assessment resources.

Together, these resources can be used to gather evidence of student learning that teachers can use to determine whether students should receive a badge. Teachers are encouraged to flexibly integrate evidence from multiple sources to determine whether students have provided sufficient evidence that they have fully mastered the CPEs for each badge.

### Forms of Evidence

Students earn badges by providing evidence that demonstrates their progress towards mastery of the CPEs. An illustration of how this evidence may be collected and evaluated throughout the implementation of a badge is shown in Figure 1 below.

**Figure 1:** Different sources of evidence to demonstrate progress towards CPE mastery.




These different forms of evidence of student learning are described in more detail in the sections that follow.

### Portfolio of Evidence

A portfolio of evidence consists of a set of student-produced artifacts demonstrating proficiency against a badge's CPEs. These artifacts are collected from student work through the learning experiences and curriculum that the teacher has aligned to each badge. The portfolio process engages students actively in assessing their growth by tasking them with the curation of a body of work that showcases evidence of their learning.

The portfolio development process includes the following steps:

- Students select artifacts and document their reflections on how that work reflects their understanding of one or more badge CPEs.
- Teachers review the student work and associated reflections and indicate whether it meets the performance expectations for the badge CPEs or whether it requires revision.
- Students iterate, reflect, and revise artifacts and reflections further through student-teacher conferencing until their work meets the performance expectations for the badge CPEs.

## Performance Tasks

For badges with a stronger emphasis on mathematical modeling (recognizable as they have "modeling" in the badge title), students are expected to complete a performance task in addition to developing a portfolio.

Performance tasks ask students to engage in mathematical modeling in authentic, real-world contexts. Students report their conclusions using media suited to the overall purpose of each task and have some agency in the selection of their preferred media (e.g., presentations, videos, reports).

XQ provides a series of standardized performance tasks that have been tested with a range of students in partner states. The teacher guides for these performance tasks include sample student work with annotations that can help teachers understand the expectations of student work for these tasks.

Teachers are welcome to use the provided tasks or develop their own, as long as the tasks are designed according to the same fundamental design criteria of the provided tasks. Moreover, the evaluation of student work should reflect the application of consistent performance expectations for CPEs across all performance tasks and student groups.

The following design criteria have been used in the development of the performance tasks; strong performance tasks:

1) Elicits evidence of skills and knowledge matter.
2) Is tight on quality criteria while open to different approaches.
3) Is authentic.
4) Offers a learning activity in and of itself.

Whenever performance tasks are used to make summative determinations about student learning as in the context of math badging, they become performance assessments.

Performance assessments:

- Use clear rubrics with specific expectations for performance
- Use rigorous and consistent evaluation processes with these rubrics
- Provide targeted evidence aligned to the assessment goals

See sources such as Darling-Hammond and Anderson (2015) or Willis, Bradynarayan, and Martinez (2022) for more information on performance tasks and performance assessments.

## Pre-/Post-Badge Tasks

Teachers should administer pre-/post-badge tasks to students before launching instruction on a new badge and, again, once badge instruction is coming to a close. At the start of the badge, these tasks are designed to support teachers in making relevant, timely decisions about how they support student learning. At the end of the badge, they are designed to help students see what they have learned from the beginning to the end of each badge.

Teachers are encouraged to utilize the “Class Summary” file for each pre-/post-badge task to gauge student understanding at the start of badge instruction, measure student progress at the end of badge instruction, and plan for any needed reengagement. The pre-/post-badge task at the beginning and end of the badge is the same task, with additional reflection questions included for the post-task, allowing for a direct comparison of how students have progressed throughout badge instruction.

The evidence about student progress from the pre-/post-badge task should inform the decision about whether students should receive a badge; however, the awarding of the badge should not solely be based on this task.

## Badge Mastery Determinations

XQ recommends a balanced, integrated judgment across the different forms of evidence shown in Figure 1, as well as any other available data that may be locally relevant but does not prescribe a particular formula for making badge mastery determinations.

While there is not a single, scientifically correct way of determining whether a student should be awarded a badge, this decision should be made systematically, supported by evaluation rubrics, student work examples, and consistent evaluation approaches.

This is best done collaboratively with other teachers who are engaged in XQ Math Badging, ideally facilitated by the district. Developing best practice locally is a valuable professional development opportunity for teachers, school leaders, and district leaders. XQ welcomes continued collaboration with the field to refine best practices in this regard.

## Cognitive Complexity Framework

Cognitive complexity is a measure of the depth of thinking required by students to solve a mathematical task or other learning activity. The XQ Math Badging framework uses Achieve’s tool for evaluating cognitive complexity in mathematics assessments, which builds on earlier work in the field on the Depth of Knowledge (DOK) framework. This refined cognitive complexity framework provides specific guidance for three degrees of cognitive complexity along three dimensions:

1) procedural skill and fluency,

2) conceptual understanding, and

3) application.

Table 1 provides an overview of the framework, representing the three levels of cognitive complexity for each of the three dimensions in a 3 x 3 table (Achieve, 2019).

This framework has been applied in the development of the pre-/post-badge tasks, the performance tasks, and the frameworks for each badge that connect the CPEs to these cognitive complexity classifications. If teachers are designing their own task or bringing in curriculum-embedded tasks, XQ recommends evaluating the alignment of the CPE coverage and associated cognitive demands of these tasks with those of the badge.

**Table 1. Framework for Evaluating the Cognitive Complexity in Mathematics Assessments**

| | Level 1 | Level 2 | Level 3 |
|---|---|---|---|
| **Procedural Complexity:** [1] | Solving the problem entails little procedural[2] demand or procedural demand is below grade level. | Solving the problem entails common or grade-level procedure(s) with friendly numbers. | Solving the problem requires common or grade-level procedure(s) with unfriendly numbers,[3] an unconventional combination of procedures, or requires unusual perseverance or organizational skills in the execution of the procedure(s). |
| **Conceptual Complexity:** [4] | Solving the problem requires students to recall or recognize a grade-level concept. The student does not need to relate concepts or demonstrate a line of reasoning. | Students may need to relate multiple grade-level concepts of different types, create multiple representations or solutions, or connect concepts with procedures or strategies. The student must do some reasoning, but may not need to demonstrate a line of reasoning. | Solving the problem requires students to relate multiple grade-level concepts and to evidence reasoning, planning, analysis, judgment, and/or creative thought OR work with a sophisticated (nontypical) line of reasoning. |
| **Application Complexity:** | Solving the problem entails an application of mathematics, but the required mathematics is either directly indicated or obvious. | Solving the problem entails an application of mathematics and requires an interpretation of the context to determine the procedure or concept (may include extraneous information). The mathematics is not immediately obvious. Solving the problem requires students to decide what to do. | In addition to an interpretation of the context, solving the problem requires recognizing important features, and formulating, computing, and interpreting results as part of a modeling process. |

1. This is based on the NAEP States Item to Item Comparison Study, NAEP Validity Studies Panel; Philip Daro, Gerunda Hughes, Sami Kamito, Fran Stancavage, Natalie Tucker-Bradway; American Institutes for Research, 2018.
2. A procedure is a step-by-step sequence that can be memorized and executed without understanding or attending to the meaning of the quantities; a procedure is useful for a class of problems or situations. Computations that are likely to be known from memory are considered procedural.
3. Unfriendly numbers: The student is likely to get the problem wrong not because of the targeted procedure but because of the numbers involved.
4. This is based on the conceptual aspects of the Mathematics Framework for the 2015 National Assessment of Educational Progress; National Assessment Governing Board, 2014.

**References**

Achieve. (2019, September). A FRAMEWORK TO EVALUATE COGNITIVE COMPLEXITY IN MATHEMATICS ASSESSMENTS. From Achieve.org: https://www.achieve.org/files/Mathematics%20Cognitive%20Complexity%20Framework_Final_92619.pdf

Darling-Hammond, L., & Anderson, F. (2015). *Beyond the bubble test: How performance assessments support 21st century learning*. San Francisco, CA: Jossey-Bass.

Willis, L., Bradynarayan, A., & Martinez, M. (2022). *Quality criteria for systems of performance assessment for school, district, and network leaders*. Learning Policy Institute. https://doi.org/10.54300/439.730