PROJECT EMBER

ELIMINATING MATHEMATICS BARRIERS THROUGH EVIDENCE-BASED REFORMS

INTRODUCTORY MATHEMATICS SELF-ASSESSMENT

July 2026

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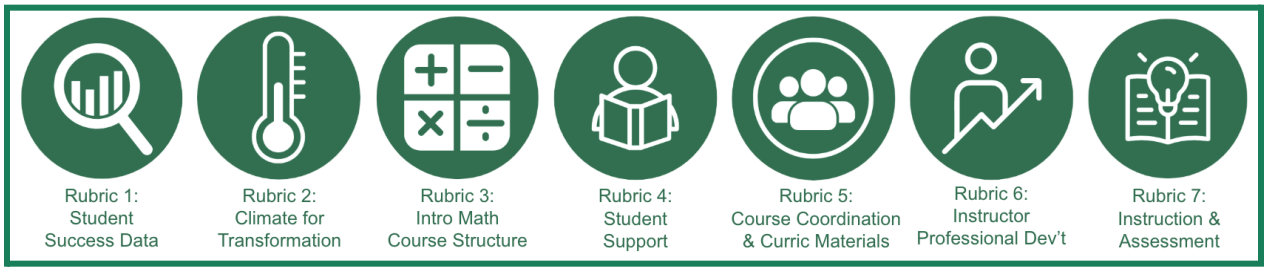
INTRODUCTION

The Project EMBER: Eliminating Mathematics Barriers through Evidence-based Reforms Introductory Mathematics Self-Assessment is a diagnostic tool designed to be used in a self-study to evaluate the work of Mathematics Departments in R1 institutions, tailored for introductory mathematics courses. This tool is based on the extensive efforts of the Partnership for Undergraduate Life Science Education (PULSE) project that focused on Biology in 4-year institutions (funded by the National Science Foundation (NSF), the Howard Hughes Medical Institute (HHMI), and the National Institute for General Medical Sciences (NIGMS/NIH) and the Teaching for PROWESS (TfP) project that focused on mathematics in community colleges (funded by the National Science Foundation). Throughout the Self-Assessment, there is an emphasis on teaching-focused faculty (TFF) as defined in paper titled, "The Status of Teaching Focused Faculty at Research Institutions" (in review):

> *At research institutions, math courses up to and including calculus are now largely run by Teaching Focused Faculty (TFF), a category of faculty that includes Teaching Professors, Senior Lecturers, Professor of the Practice, and other titles – most of which did not exist several decades ago. The work of these dedicated mathematicians varies substantially across institutions. Their work and student success in introductory courses are impacted by TFF prevalence, responsibilities, rights, and ability to implement research-backed reforms (p. 1).*

PURPOSE

The Project EMBER self-assessment diagnostic tool includes a collection of rubrics meant to highlight the areas in introductory mathematics that are going well and areas where progress can be made. The rubrics also facilitate the introductory mathematics team's ability to identify *how* to make improvements by offering exemplar definitions of criteria for which to aspire.



The self-assessment tool is intended to be used by Mathematics Departments to self-evaluate their effectiveness in *Introductory Mathematics* in the following areas:

- **Rubric 1: Student Success Data**
    - Highlights the local data that should be gathered, with one section focused on tracking and using local student data.
- **Rubric 2: Climate for Transformation**
    - Assesses institutional, administrative, and departmental openness to and movement toward change in mathematics education.
- **Rubric 3: Introductory Mathematics Course Structure**
    - Assesses introductory course structures to determine alignment with the current needs of students and partner disciplines.
- **Rubric 4: Student Support**
    - Assesses the extent that departments and institutions create an environment ripe for optimizing mathematics learning for all students.
- **Rubric 5: Course Coordination and Curriculum Materials**
    - Assesses course coordination as a means for improving mathematics education and how it is integrated into the work.
- **Rubric 6: College Mathematics Instructor Professional Development**
    - Assess professional development offerings for new and seasoned faculty across all instructional ranks, including graduate student instructors.
- **Rubric 7: Instruction and Assessment of Student Learning**

- Assesses the use of evidence-based instructional strategies to enhance student learning and how faculty use these results to guide instruction.

CATEGORIES AND RATINGS

Each rubric contains defined criteria with 5 categories and ratings: (1) *baseline, (2) beginning, (3) developing, (4) accomplished, and (5) exemplar*. The criterion should be rated initially by individuals, then collectively as a group as they come to consensus on each criterion. The goal is not to strive for exactness, but rather a consensus on the rating based on the information the team has collectively. The following is a general description of each rating category:

- **Baseline (1).** This rating should be used when the criterion is not occurring at all.
- **Beginning (2).** This rating should be used when the criterion is in the beginning stages of development, but efforts have not been made or plans are just barely underway to carry out the criterion.
- **Developing (3).** This rating should be used when the criterion is under development, efforts and interests point to a commitment of change, but that more efforts need to be made.
- **Accomplished (4).** This rating should be used when the criterion is established and is on its way to becoming normative, though additional efforts need to be entrenched in the work.
- **Exemplar (5).** This rating should be used when the criterion is fully implemented and efforts serve as a stellar example of the criterion's focus. The goal of Project EMBER is for criterion at the exemplar rating to be normative with efforts in place to prevent backsliding.

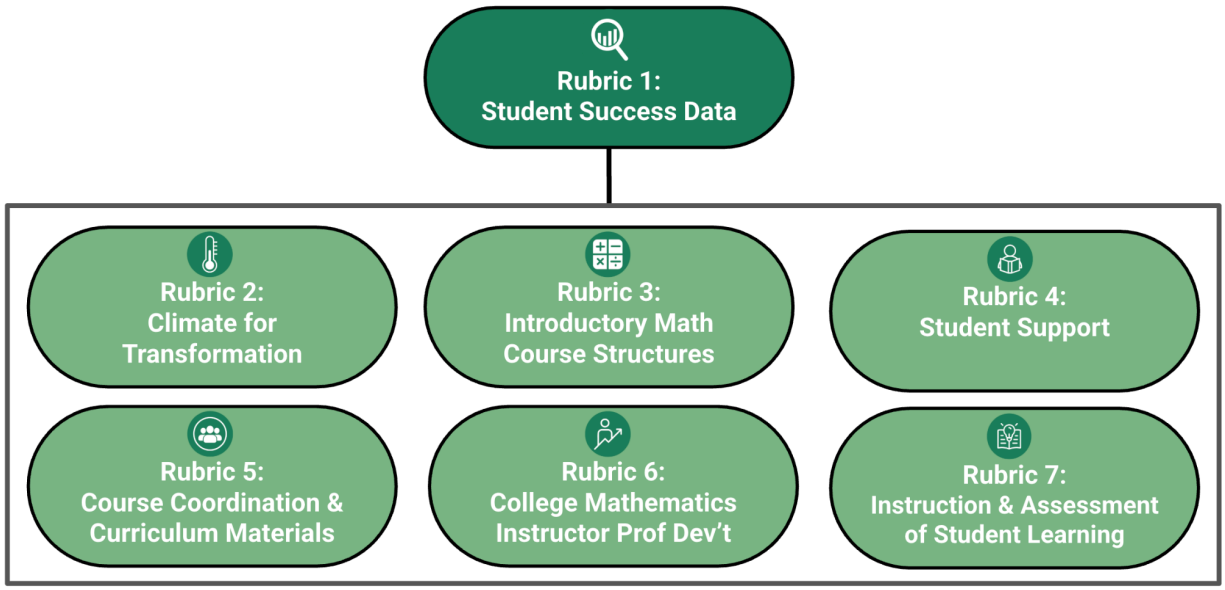
At times, teams may find it difficult to determine which category best describes the work occurring in introductory mathematics and might be compelled to give a halfway rating. The rubrics are for helping teams determine where they are at, so it is welcomed to give "halfway ratings" as needed. For example, the team may find that only part of the rating definition is met, but they have advanced beyond the lower rating. In this case, the team may decide to award a rating of 1.5, 2.5, 3.5, or 4.5 if this best describes the work happening for introductory mathematics.

PROCESS

We anticipate that it will take 5-7 hours to complete all rubrics. **A web-based platform for managing a team's responses is available** (contact admin@tpsemath.org to discuss access.) This electronic document contains the same information and the same rubrics. **Teams should begin their work by first making their own copy of this self-assessment document**, then beginning with Rubric 1: Student Success Data, which includes a request for data to be gathered. Since this process could take a few weeks at some institutions, we suggest requesting this data immediately.

A subset of the cross-functional team will complete the Self-Assessment Tool. We recommend that each member of the (sub)team first fill out each of the rubrics individually, recording their ratings and justification for each of the criteria. The team will then meet to discuss individual responses and come to a consensus for a team response for each criterion of each rubric after discussing how the criterion connects to the work focused on introductory mathematics. After each criteria cluster, the team should provide a brief justification to support the ratings of the criteria within that specific cluster. This justification will serve a dual purpose of reminding the team of the reasoning behind the ratings and also informing the Project EMBER self-assessment team about the reasoning for the rating choices. Additionally, there is space after each criteria cluster to take notes about what it would take to get to the next rating level, which will help the team identify concrete ideas of what actions could be taken to move forward and will help the team as they generate a potential wish list for the action plan phase of the work (as discussed in the Project EMBER Guidebook).

One successful meeting structure, once faculty have rated the rubrics individually, is for the team to meet and discuss two rubrics at a time in a one-hour setting. Depending on the disparity in individual responses, this process may take longer. Regardless, it is important to reach consensus on these rubrics, as they inform the action plan for change in introductory mathematics that will occur. While the self-assessment team placed the rubrics in a particular order (referenced by the numbering of the rubric), the teams should navigate through the rubrics in an order that makes sense to them. See the flowchart below as a reference.


Rubric 1:
Student Success Data
Rubric 2:
Climate for
Transformation
Rubric 3:
Introductory Math
Course Structures
Rubric 4:
Student Support
Rubric 5:
Course Coordination &
Curriculum Materials
Rubric 6:
College Mathematics
Instructor Prof Dev't
Rubric 7:
Instruction & Assessment
of Student Learning

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PROJECT EMBER: INTRODUCTORY MATHEMATICS SELF-ASSESSMENT
RUBRIC 1 — STUDENT SUCCESS DATA (Data Collection Request and 2 Criteria)

The purpose of this rubric is to highlight the local data that should be gathered as part of the self-assessment process. Any attempt to improve student performance in a course requires the collection of data by semester or term over a multi-year period. The purpose of gathering these data is not to identify solutions to perceived problems, but to better understand what problems exist. In particular, such data can aid in identifying subpopulations that are underperforming. This enables the introductory mathematics team to initiate studies to better understand why these subpopulations are struggling.

Professor Marco Molinaro at the University of Maryland (marcom@umd.edu) has agreed to serve as a resource for the introductory mathematics team that are engaged in collecting data for a particular course that has been targeted for investigation. He recommends identifying a person with familiarity with programming and scripting languages like R to work with the data and possibly also with Tableau or other data visualization tools. Professor Molinaro will share appropriate tools with the local data person. He also recommends identifying someone who has trust within the department and who has the authority to request the needed data from the Institutional Research office or other sources within the university. Professor Molinaro is willing to work with this person to identify sources of data and means of collecting them.

A discussion of data usage can be found in the National Academies report *Transforming Undergraduate STEM Education: Supporting Equitable and Effective Teaching (2025)*. The section on data (which starts on page 239 of the full report) can be downloaded at tinyurl.com/EMBER-Using-Data.

It is important that data collection will always be course-wide, temporal (by term) and not identifiable by individual instructors. The intent is not to single out individual instructors for praise or criticism, but to find systemic issues that require the institution's attention. The focus of this data collection will be on DFW rates for the course, disaggregated by individual student characteristics. Such student categories can include:

1. Gender
2. Race and ethnicity (It should be possible for students to select multiple races and/or ethnicities. Suggested possibilities: American Indian/Alaskan Native, Asian/Asian American, Black, Hispanic, Pacific Islander, White, Nonresident.)
3. Socio-economic status (Ideally, this could be by recipients of Pell grants, but this information is generally difficult to obtain. Other proxies include home address and census bureau data on economic status by census track or percentage of free or reduced lunch at high school from which students graduated. An alternative is to use census-tract based opportunity measures such as the Child Opportunity Index)
4. First generation to attend college or not
5. Urban, suburban, or rural
6. Entered university as freshman or transfer or is dual enrollment
7. Intended major and/or college within the university
8. Semester or term in which student is taking this course
9. Full-time or part-time status
10. Commuting or non-commuting student

These data can be collected at the individual student level for each course, or be given in aggregate by course and term. The individual student level data allows for much greater flexibility in doing analyses that intersect multiple identities (such as first generation and

Pell recipients versus those in neither group) but can quickly lead to small cell sizes, generally understood to be less than 5 persons, which may compromise student privacy and should be avoided in data reporting. The collected data can then be benchmarked against comparable universities to determine whether the course is sufficiently serving the enrolled students as a whole, or whether there are identifiable groups of students who are significantly underperforming.

Note: As the team works through this rubric, it might be helpful to refer to the Reflection Questions for Guiding Idea Generation section in the Project EMBER Guidebook [https://www.tpsemath.org/project-ember-guidebook]. It might also be wise to capture ideas on your own for possible improvements to introductory mathematics that organically emerge.

A. TRACKING AND USING LOCAL STUDENT DATA

CRITERION 1.A1: Collecting and utilizing local student data. For each course that is being studied, the department tracks multiple types of student data and uses them to identify potential issues, particularly identifying subpopulations that are underperforming and that require further study to understand why this is happening. This criterion addresses the extent to which the department is aware of student success in the given course including grades and other measures of individual student outcomes, persistence into subsequent courses that rely on what students should carry from this course, and success in these subsequent courses. This criterion addresses the need to track and examine disaggregated student rates of success by semester or term over several years. Suggestions for types of data are listed in the introduction to this rubric.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
No data are regularly collected or analyzed for assessment of student success.	Student grades are collected by semester or term and coursewide DFW rates are observed for seasonal patterns.	The department has begun to track variables such as gender or race that aid in identifying subpopulations that require greater attention.	The department tracks a rich set of variables that aid in identifying subpopulations that require greater attention. It has begun to track persistence into and success within subsequent courses.	The department is using visualizations of a rich set of student variables collected over a multiyear period that identify potential problems that require further study. It benchmarks its results against comparable institutions. And it investigates downstream effects of its course on various subpopulations.

CRITERION 1.A2: Sharing and discussing local student data. The data that is collected and analyzed regarding student outcomes is of little value if it is not shared with the instructors teaching the courses and incorporated in discussions between instructors in an effort to understand root causes of undesirable outcomes.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
No data are shared with instructors.	General data for course outcomes, such as DFW rates, is made easily available but it is not tied to individual terms or able to be disaggregated by student characteristics.	Outcome data can be easily accessed by term and instructor but disaggregation/intersection of variable options are limited and faculty conversations ad-hoc.	The department makes all outcome data available to instructors in an aggregated fashion and encourages faculty to discuss ways to minimize unwanted student outcomes.	Faculty in the department can regularly access visualizations related to their students' outcomes in the courses they teach as well monitor overall student outcomes in all lower division courses. Discussions of outcomes and root causes are an expected part of their professional role and are encouraged and structured by the department.

Justification for 0.A1 and 0.A2 Ratings:

PROJECT EMBER

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PROJECT EMBER: INTRODUCTORY MATHEMATICS SELF-ASSESSMENT
RUBRIC 2 — CLIMATE FOR TRANSFORMATION (6 criteria)

The purpose of this rubric is to assist introductory mathematics teams in assessing the institutional, administrative, and departmental openness to and movement toward the type of change outlined for mathematics education. Although many of these criteria are out of the control of departments and faculty, they are critical for transformation and sustainability of reform efforts in mathematics education. The criteria included in this rubric are broadly applicable to other STEM disciplines.

There is no doubt that the efforts of charismatic and energetic individuals are critical to catalyzing transformation and/or reform. However, there is a critical role for department chairs and senior level administration (e.g., deans, provosts, and other administrators whose role is directly related to undergraduate instruction) at a given institution to play in setting a tone or climate that is conducive to change efforts. In addition to allocating basic resources necessary for teaching, senior administration determines to a large extent what efforts are recognized and/or rewarded. Departments that have a positive climate for change – positive working relationship and/or empowerment by the institution's administration – are more likely to be successful in the long term in their efforts to reform mathematics education. Therefore, although this rubric can be challenging to complete given the qualitative nature of the items being assessed and the fact that departments often have little control of these criteria, this rubric measures an important component for promoting transformation within introductory mathematics.

Note: As the team works through this rubric, it might be helpful to refer to the Reflection Questions for Guiding Idea Generation section in the Project EMBER Guidebook [https://www.tpsemath.org/project-ember-guidebook]. It might also be wise to capture ideas on your own for possible improvements to introductory mathematics that organically emerge.

A. ATTITUDE TOWARD TRANSFORMATION INITIATIVES

CRITERION 2.A1: **Administrative (e.g., department chair, dean, provost) support for state and national transformation initiatives in higher education, with special focus on mathematics education.** This criterion addresses the degree to which the administration is aware of, has read about, and acts on state and national change initiatives and recommendations in higher education, especially as they relate to mathematics education. State initiatives may be created by state-wide task forces, steering committees, forums, or summits. National initiatives may be from national mathematics organizations included in the Conference Board of the Mathematical Sciences or by other groups such as the Charles A. Dana Center, Carnegie Foundation for the Advancement of Teaching, PCAST, TPSE Math, Common Vision.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
Administration is not aware of state and national initiatives or does not acknowledge these initiatives in higher education or mathematics education.	Administration is aware of and has read about state and national initiatives in higher education and mathematics education, but no action is taken.	Administration supports enacting state and national initiatives in higher education and mathematics education, but no long-term plan or funding is in place.	Administration takes action regularly to enact state and national initiatives in higher education and mathematics education, and a short-term action plan is in place.	Administration takes action regularly to enact state and national and state initiatives in higher education and mathematics education; administration allocates resources and establishes a long-term action plan.

CRITERION 2.A2: **Attitude of teaching-focused faculty (TFF) toward state and national transformation initiatives in higher education, with special focus on mathematics education.** This criterion addresses the degree to which the TFF are aware of, has read about, and acts on state and national change initiatives and recommendations in higher education, especially as they relate to mathematics education. State initiatives may be created by state-wide task forces, steering committees, forums, or summits. National initiatives may be from national mathematics organizations included in the Conference Board of the Mathematical Sciences or by other groups such as the Charles A. Dana Center, Carnegie Foundation for the Advancement of Teaching, PCAST, TPSE Math, Common Vision.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
TFF are not aware of state and national initiatives, do not acknowledge these initiatives in higher education or mathematics education, or are antagonistic toward teaching innovations.	TFF have read about state and national transformation initiatives in higher education and mathematics education, but do not implement them (i.e., faculty are change averse). Overall faculty opposition to teaching innovations is decreasing.	TFF are aware of and discussing state and national transformation initiatives in higher education and mathematics education. Overall faculty opposition to teaching innovations is improving even more.	TFF are discussing state and national transformation initiatives in higher education and mathematics education, and establishing short-term action plans.	TFF are implementing state and national transformation initiatives in higher education and mathematics education, and establishing long-term action plans.

Justification for 2.A1 & 2.A2 Ratings:

B. STRATEGIES FOR PROMOTING SYSTEMIC TRANSFORMATION

CRITERION 2.B1: **Institutional support for teaching-focused faculty (TFF) to develop and update courses.** This criterion is focused on the degree to which the institution supports the efforts of TFF to develop and update courses to align with the institution's expectations and national recommendations. The underlying issue here is that it takes time to create a new course or to redesign a current course to make changes such as moving from an instructor-focused lecture course to a student-focused course engaging students in active learning. Many TFF express interest in changing the way they teach but find it difficult or impossible to do it due to pressing commitments. Thus, institutional support that incentivizes TFF, such as providing stipends or release/reassign time for course development or redesign, can be critical. Institutions may also fund course leads who provide templates for redesigned courses.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
Course development and redesign are not recognized as an important activity.	Course development and redesign are recognized as important activities, but no incentives or resources are provided.	Course development and redesign are recognized as important activities; incentives and resources not defined, are minimal, and are granted infrequently.	Course development and redesign are recognized as important activities with well-defined incentives and resources, but funding is not consistently available.	Course development and redesign are encouraged and supported. Faculty innovations in teaching are encouraged with substantive incentives and resources provided by policy and/or sustained institutional funding.

Justification for 2.B1 Ratings:

C. CONCRETE IMPLEMENTATIONS PROMOTING TRANSFORMATION

CRITERION 2.C1: **Mechanisms for collaborative communication between teaching-focused faculty (TFF) and tenure-track faculty on significant educational challenges.** This criterion addresses the degree to which TFF and tenure-track faculty across the institution effectively communicate about nationally-recognized and institution-specific challenges and issues in mathematics education. Such discussions might include how to address recommendations from national reports and studies, educational best practices, data on student outcomes, and measures of student success. Institution-specific data and issues might include DFW rates, retention, persistence, success of students from non-traditional and underrepresented backgrounds, and outcomes such as graduation rates, types of employment, rate of entry into additional educational programs, etc. For scores of 3 and 4, formal mechanisms such as committees, professional learning communities, or working groups that actively engage TFF with tenure-track faculty across the institution around these issues exist. An example of an evidence-based working group structure to promote change in higher education departments is the Departmental Action Teams model. To achieve a score of 4, discussions that identify significant disparities or issues must lead to changes in programs to address those concerns.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
There is little discussion of educational challenges that impact student success (e.g. retention, persistence, success of underrepresented students).	There is informal discussion of educational challenges that impact student success, but discussions include only a limited group of TFF and tenure-track faculty with infrequent, irregular meetings.	Informal discussion of educational challenges that impact student success includes the majority of college stakeholders, but there are no mechanisms for collaborative communication.	Formal communication mechanism (committees, professional learning community or working groups) exists for discussion of educational challenges that impact student success. The committee includes the majority of TFF and tenure-track faculty.	Formal communication mechanism committees, professional learning community or working groups) exists for discussion of educational challenges that impact student success. The committee includes the majority of TFF and tenure-track faculty, who collaborate actively to make impactful changes.

CRITERION 2.C2: **Institutional assessment of student engagement and learning.** This criterion reflects the culture of an institution in understanding the learning experience of their students and using that information to inform improvements in their general education and disciplinary programs. Institutions with a strong, positive culture of assessment and evaluation often foster and support those processes at a program level. Best practices in institutional assessment would include sharing of data with a broad spectrum of stakeholders across the institution and use for improvement in institutional structures, the general education experience, and in the curricula required for specific programs. Indirect measures usually ask students to complete surveys or respond in focus groups regarding their perception of their learning, engagement, and/or their satisfaction with their experience at the institution. Direct measures are aimed at directly evaluating student skills or knowledge, measured either with artifacts produced within courses or through end of course or end of program assessments.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar

Minimal compliance with what is required for institutional accreditation, but no genuine effort to engage institutional stakeholders in meaningful evaluation of engagement and learning.	Most data are derived from indirect satisfaction surveys, and efforts to collect direct evidence on engagement and learning are limited, fragmented or uncoordinated.	Some data from both indirect and direct sources are collected, but dissemination of results is limited; these data are used generically for improvement of the student experience.	Direct and indirect data are collected with emphasis on direct measures; results are broadly disseminated, and data are used generically for improvement of the student experience.	Student engagement and learning is assessed using a mixture of direct and indirect instruments; results are broadly disseminated, and data are used to improve specific outcomes such as persistence and career path success.

C. CONCRETE IMPLEMENTATIONS PROMOTING TRANSFORMATION

CRITERION 2.C3: **Formal evaluation of teaching-focused faculty (TFF) and tenure-track faculty with a focus on teaching and learning.** The purpose of formal evaluation of faculty should be to assist faculty to use the latest research to improve teaching and learning. Formal evaluation includes regular/annual review as well as review for promotion/tenure of faculty. These formal evaluations should include scholarly teaching using the following criteria: student evaluations, peer and/or administrator evaluations, and self-assessment/reflection. Scholarly teaching is the practice of evaluating whether students achieve learning goals and reflecting on teaching practices to continuously improve student learning. Student course evaluations vary from institution to institution. At a minimum, course evaluations ask for student perceptions about the quality of the class and the quality of the faculty. At the high end, course evaluations might ask about the teaching approaches utilized and student perception of learning gains. Peer or administrator evaluations are when others assess teaching effectiveness and can include information about the strategies utilized and the level of student engagement. The self-assessment/reflection should include utilizing the student and peer evaluations, as well indirect measures, to improve their teaching and student learning.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
There is no connection between evaluation of faculty and improvement of learning.	Evaluation of faculty is based on only one or the criteria and has minimal impact for improvement of learning.	Evaluation of faculty is based on two of the criteria and some attempt is made to use the data to improve teaching and learning.	Evaluation of faculty is based on all three of the criteria and instructors are expected to use the data to improve teaching and learning.	Evaluation of faculty is based on all three criteria and a formal structure is in place that helps instructors use data from the different criteria to improve teaching and learning.

Justification for 2.C1, 2.C2, & 2.C3 Ratings:

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PROJECT EMBER: INTRODUCTORY MATHEMATICS SELF-ASSESSMENT
RUBRIC 3 — INTRODUCTORY MATHEMATICS COURSE STRUCTURES (5 criteria)

The purpose of this rubric is to assess introductory course structures in mathematics to determine how best they align with the current needs of students and current needs of partner disciplines. While not all institutions offer non-credit-bearing mathematics courses, the rubric does inquire about whether these courses are offered to students to further prepare them for credit-bearing courses. In addition, the collaboration and alignment of courses with partner discipline departments is assessed in this rubric to highlight that mathematics is a discipline that serves a wide-range of other disciplines. Additionally, we invite teams to decide what specific courses and pathways they should focus on that best serve the work within their context. Teams might consider copying this rubric or portions of the rubric multiple times to complete for each specific course and/or pathway. Alternatively, teams could keep as one rubric and complete once by aggregating the targeted courses to arrive at the chosen rating.

Note: As the team works through this rubric, it might be helpful to refer to the Reflection Questions for Guiding Idea Generation section in the Project EMBER Guidebook [https://www.tpsemath.org/project-ember-guidebook]. It might also be wise to capture ideas on your own for possible improvements to introductory mathematics that organically emerge.

A. INTRODUCTORY MATHEMATICS COURSE OFFERINGS

CRITERION 3.A1: **Supplemental support courses are offered by the Mathematics (or other) Department for students not prepared to take credit-bearing college mathematics courses.** This criterion addresses the extent to which the department offers courses designed to provide additional academic support for students, such as, corequisite courses, non-credit bearing courses, stretched out courses, or developmental mathematics courses. Additionally, this criterion addresses the need to replace developmental mathematics courses (offered prior to a student taking credit-bearing courses) with co-requisite courses offered concurrently with credit-bearing courses.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
The department does not offer any academic support courses. Students must take credit-bearing courses, regardless of their preparedness.	The department offers limited non-credit bearing academic support courses or developmental mathematics courses, but they are not clearly designed to align with the course pathways. There is no integration of co-requisite (or stretched) courses.	The department offers developmental mathematics courses prior to credit-bearing courses. These courses are somewhat aligned with the course pathways. Corequisite (or stretched) courses are available for some relevant credit-bearing courses.	The department offers a range of academic support courses designed to support students in course pathways. Corequisite courses are available and are integrated effectively into the relevant credit-bearing courses.	The department offers a comprehensive and well-coordinated suite of academic support courses, including fully integrated corequisite courses for all relevant credit-bearing courses. All developmental mathematics courses have been replaced with co-requisite (or stretched) courses.

CRITERION 3.A2: **Department offers course sequences that meet the needs of partner disciplines.** This includes offering course variations based on partner discipline needs (e.g., Biological Sciences, Engineers, Business), as well as courses for students who need additional preparation (e.g., honors, accelerated).

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
No discipline-specific courses are offered.	Limited course variations focused on one partner discipline.	Moderate range of course variations covering several disciplines.	Wide range of course variations meeting the needs of most major disciplines.	Course variations are tailored to meet the needs of vital major and minor disciplines.

Justification for 3.A1 and 3.A2 Rating:

B. ALIGNMENT OF INTRODUCTORY COURSE OFFERINGS

CRITERION 3.B1: **Alignment of credit-bearing course offerings.** This criterion addresses the extent to which credit-bearing course offerings are vertically and horizontally aligned. That is, student learning objectives have been mapped out for each of the courses and there is clear progression of learning objectives from one course to the next in the sequence.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
No clear mapping of student learning objectives.	Limited mapping of student learning objectives (e.g., mapping of some SLOs within a course, but not across multiple courses in the sequence).	Some mapping of student learning objectives (e.g., mapping of SLOs within a course, but not across multiple courses in the sequence).	Clear mapping of student learning objectives within and across courses in the sequence.	Comprehensive mapping of student learning objectives within and across courses with detailed documentation; seamless progression from one course to the next.

CRITERION 3.B2: **Alignment of non-credit-bearing course offerings to support students' success in credit-bearing courses.** This criterion addresses the extent to which academic support courses (i.e., non-credit bearing courses) are designed to support students' success in credit-bearing courses. That is, there is alignment between the learning objectives of the primary course and the support course (e.g., corequisite courses, non-credit bearing courses). Additionally, there is alignment between the learning objectives in developmental mathematics courses and the subsequent credit-bearing courses. This ensures that students are prepared for the content covered in credit bearing courses. If the academic support courses are not overseen by the department, then it is critical for the department (and, specifically, introductory mathematics faculty) to collaborate with these units to ensure students are effectively supported.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
Little to no alignment between primary and support courses. Students are underprepared for credit-bearing courses.	Limited alignment between primary and support courses. Students face challenges in credit-bearing courses.	Some alignment of primary and support courses, but may be inconsistent. Students are prepared for some areas of credit-bearing courses, but not all areas.	Primary and support courses are well-aligned. Most students are prepared to be successful in credit-bearing courses.	Comprehensive mapping of student learning objectives with detailed documentation between primary and support classes. Students in non-credit bearing courses are prepared to be successful in credit bearing courses.

CRITERION 3.B3: **Mathematics pathways alignment.** This criterion addresses the goal of getting students into introductory mathematics courses that are aligned with the mathematical needs of their chosen (or likely) academic programs (called meta-majors). The traditional default introductory course (typically College Algebra or Precalculus) is not well aligned with the needs of most students in the social sciences, humanities, or with most professional programs. Those students may be better served in Introductory to Statistics (without a College Algebra prerequisite) or a Quantitative Reasoning course. Getting students into those classes involves careful coordination, matching introductory courses with groups of majors that share similar coursework (e.g., STEM majors). Involvement of all stakeholders is key: students, advisors, placement systems, introductory course instructors, and student support units. For more, see the Dana Center's Math Pathways.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
There is no attempt to align students' math courses with their intended major.	Some meta-majors are aligned with introductory mathematics (e.g. statistics for social sciences) but students in other programs of study still go into the path to calculus.	Meta-majors are aligned with mathematics courses, however many students still go into the default course (e.g. College Algebra or Precalculus) no matter what their interests and aspirations.	Meta-majors are aligned with mathematics courses. Students are placed into introductory courses by default based on their intended program of study. Constant attention to advising and placement is needed to not revert to prior default placements.	Meta-majors are aligned with mathematics courses and students are placed into credit-bearing introductory courses (with corequisite support if needed) by default based on their intended program of study. Dual credit offerings and enrollments reflect these pathways. All of this is normative practice. Students in the path to Calculus are there because they intend to take Calculus – and throughput for that path is high.
Justification for 3.B1, 3.B2, & 3.B3 Ratings:				

PROJECT EMBER

ELIMINATING MATHEMATICS BARRIERS
THROUGH EVIDENCE-BASED REFORMS

PROJECT EMBER: INTRODUCTORY MATHEMATICS SELF-ASSESSMENT
RUBRIC 4 — STUDENT SUPPORT (6 criteria)

The purpose of this rubric is to assess the extent to which the introductory mathematics team and their institutions create an environment that has the potential to optimize mathematics learning for all students. Creating a learning environment that maximizes student learning in mathematics and responds to the needs of all students requires the active involvement of every teaching-focused faculty and each component of the institution. The focus of this rubric is on supporting students through effective placement and advisement, opportunities for supplemental assistance and experiential learning, building community among students, and coordination of tutoring support.

Note: As the team works through this rubric, it might be helpful to refer to the Reflection Questions for Guiding Idea Generation section in the Project EMBER Guidebook [https://www.tpsemath.org/project-ember-guidebook]. It might also be wise to capture ideas on your own for possible improvements to introductory mathematics that organically emerge.

A. EFFECTIVE PLACEMENT AND ADVISEMENT

CRITERION 4.A1. The Department/Introductory Mathematics Team has an effective system for placing students in the appropriate mathematics course(s) based on their intended pathway. This criterion addresses the need for departments to use multiple data points when placing students in mathematics class(es). These data points could take the form of high school GPA, mathematics courses completed and outcomes, ACT/SAT scores, departmental placement test, or adaptive placement test (e.g., ALEKS). Departments/teams should review placement procedures periodically to ensure accurate placement.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
The department/team does not have a structured placement system for mathematics courses.	The department/team has a basic placement system but relies on a single data point, such as a single placement test, high school GPA or ACT/SAT scores, for placing students in mathematics courses. There is no periodic review of placement procedures.	The department/team uses multiple data points for placing students in mathematics courses. There is no periodic review of the effectiveness of placement procedures.	The department/team uses multiple data points for placing students in mathematics courses. Placement procedures are reviewed periodically, but the process is not systematic.	The department/team has an effective placement system that uses multiple data points The department conducts systematic and periodic reviews of placement procedures to ensure accurate placement. Feedback from students and faculty is used to refine the placement process.

CRITERION 4.A2. The Department/Introductory Mathematics Team coordinates and collaborates with advisors on initial course placement. This criterion focuses on coordination among the department/team and advisors, with a focus on determining initial course placement for students. The coordination efforts may include regular communication by the department/team to inform advisors about the needs of the department/team relative to correct course placement. In some institutions, students are placed firmly in an initial course by advisors and in other institutions, students are provided choice to determine which course to begin their mathematics pathway. Coordination and collaboration among the department/team and advisors is important for carrying out best practices for placing students appropriately.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
The department/team and advisors do not coordinate or collaborate. Advisement occurs in a silo.	The department/team and advisors collaborate infrequently on matters pertaining to initial course placement, but advisement still tends to occur in a silo.	The department/team and advisors coordinate and collaborate occasionally with a shared interest in placing students appropriately. Progress is being made where advisement occurs in conjunction with the department/team.	The department/team and advisors coordinate and collaborate frequently with a shared interest in placing students appropriately. Advisors are knowledgeable of the needs of the department/team.	The department/team and advisors regularly coordinate and collaborate in order to implement best practices for placing students into their initial math course. Advisors feel well-informed by the department/team and understand the needs of the department/team and students for placement.

Justification for 4.A1 Rating:

B. OPPORTUNITIES FOR SUPPLEMENTAL ASSISTANCE

CRITERION 4.B1. Accessibility of supplemental assistance for student success. This criterion addresses whether the department/introductory mathematics team and/or institution offers supplemental assistance that meet the needs of students. The college must provide appropriate spaces and resources (such as technology) that support this assistance. Ideally, supplemental assistance opportunities are provided at convenient times and locations for students, free to students, and have sufficient capacity. These opportunities may include tutoring, peer mentoring, supplemental instruction, academic advising, and student learning communities.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
Supplemental assistance opportunities are absent.	One or two supplemental assistance opportunities are offered, but accessible to few students.	Supplemental assistance opportunities are diverse, but only accessible to some students.	Supplemental assistance opportunities are diverse, widely accessible to many students.	Supplemental assistance opportunities are diverse, widely accessible to all students, and institutionalized by permanent funding.

CRITERION 4.B2: **Mathematics tutoring is coordinated with the needs and efforts of the department/introductory mathematics team.** This criterion is focused on the level of coordination and collaboration among the department/team and all tutoring services that directly support the mathematics courses offered by the department/team. Many institutions provide additional tutoring assistance outside of the department/team, and while it would be ideal for coordination of all mathematics tutoring effects, this criterion centers on the services that support the department's/team's courses specifically. Providing coordinated tutoring support is critical for seamless, consistent tutoring assistance to facilitate student success. These coordination efforts should be funded and supported by the institution and dedicated personnel should be in place to lead tutoring services and train tutoring staff. Coordination efforts should be driven by data, including data to show detailed student utilization (i.e., includes specific students tied to specific course(s)), and shared with the department/team.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
The department/team has little or no awareness of what is happening with tutoring services.	Mathematics tutoring is not coordinated between tutoring services and the department/team. The department is only vaguely aware of what is happening in the tutoring services.	Mathematics tutoring efforts are lightly coordinated between tutoring services and the department/team, yet efforts to collect and/or share student utilization data are not yet in place.	Mathematics tutoring efforts are coordinated between tutoring services and the department/team. Efforts to collect and/or share student utilization data are emerging.	Mathematics tutoring is fully and intentionally coordinated with the needs and efforts of the department/team. Data on student utilization, including specific students with specific courses, are shared with the department/team so that faculty are aware of which students are using tutoring services.

CRITERION 4.B3. Sharing of data regarding student participation in supplemental assistance opportunities. This criterion assesses whether data is collected on student participation and utilization in supplemental assistance offered by the institution and whether this data is shared with the mathematics department/team to confirm that the assistance opportunities are serving the specific groups of students for which they are directed.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar

No data on student participation in supplemental assistance is collected and thus, there is no communication between the department/team and student support units regarding student usage.	Data is collected on student participation in supplemental assistance, but not regularly shared with the department/team. There are data available to the department/team upon request, but could be in a format that is not helpful.	A report is regularly shared (e.g., end of term or academic year) with the department/team from the support unit(s) regarding student and course usage, but the report is not customizable and might not be as helpful as desired.	In addition to the report regularly shared by the student support unit(s), data is disaggregated and shared with the department/team in various ways to identify potential student groups in specific courses that may need additional support.	There is regular data-informed communication between the department/team and student support unit(s) about student usage so that targets for improvement can be made to support specific student groups in specific courses. Data is disaggregated in various ways and regularly examined by both the department/team and student support unit to inform decisions regarding improvements.
Justification for 4.B1, 4.B2 and 4.B3 Ratings:				

C. BUILDING COMMUNITY AMONG STUDENTS

CRITERION 4.C1. The department/ introductory mathematics team works to build students' sense of belonging and community. This criterion includes the extent to which the department/team (and instructors) work to build a sense of community for students within the core courses, STEM majors, experiential learning opportunities, etc. This may also include hosting events (such as inviting speakers who work in STEM fields to share their experiences) or creating community work spaces for students (such as tutoring centers or common space for students to work). In order to gauge student sense of belonging and community, the department/team will need to have mechanisms in place to gather feedback from students. This could take the form of informal conversations, more formalized interviews or focus groups, or surveys.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
Minimal or no effort to foster a sense of community among students.	Limited or sporadic efforts to build community among students. Efforts to build community among students may be limited to individual instructors' and their classes.	Moderate efforts to foster belonging and community among students. Some feedback from students is gathered to learn about students' sense of belonging, but the feedback is not used to improve initiatives.	Consistent and effective efforts to build a sense of belonging and community among students. Community-building is integrated into more core courses. Student feedback is regularly sought and used to improve initiatives.	Consistent and effective efforts to build a sense of belonging and community among students. Community-building is embedded across the department/team. Student feedback is consistently gathered, analyzed, and acted upon to enhance community-building strategies.

Justification for 4.C1 Rating:

PROJECT EMBER

ELIMINATING MATHEMATICS BARRIERS THROUGH EVIDENCE-BASED REFORMS

PROJECT EMBER: INTRODUCTORY MATHEMATICS SELF-ASSESSMENT
RUBRIC 5 — COURSE COORDINATION & CURRICULUM MATERIALS (9 criteria)

The purpose of this rubric is to assess whether introductory mathematics teams are leveraging course coordination as a means for improving the teaching and learning of mathematics and to assess the extent to which course coordination is integrated into the work of the department/team. This also includes the extent to which faculty have been thoughtfully positioned in their roles as course coordinators, TA trainers and professional development providers, and other relevant roles.

If a department/team does not have coordinated courses, it is recommended that the self-assessment team still review this rubric to get a sense of what is involved in setting up such a coordinated system. The criteria in this rubric should still be discussed among the team members and considered for future actions the department/team could take. If a department has various levels of coordinated courses and/or various courses that are coordinated, it is suggested that the team consider completing the rubric for groups of courses, as appropriate. For example, the team might complete this rubric for all coordinated *non-credit-bearing* courses and then have separate ratings for all coordinated *credit-bearing* courses. Another example could be the group of courses for STEM intending students versus non-STEM intending students, as the vision or goals for these course groups may differ. If so, we invite you to make separate notes in the justification section(s) as needed.

Note: As the team works through this rubric, it might be helpful to refer to the Reflection Questions for Guiding Idea Generation section in the Project EMBER Guidebook [https://www.tpsemath.org/project-ember-guidebook]. It might also be wise to capture ideas on your own for possible improvements to introductory mathematics that organically emerge.

A. THE ROLE OF COURSE COORDINATORS

CRITERION 5.A1: **The department/introductory mathematics team has defined roles and responsibilities for course coordinators.** This criterion focuses on whether the department/team has a defined role for course coordinators, the nature of this role, and whether this role has defined responsibilities to ensure that the needs and potential of course coordination are being met and realized. The underlying concern is that without a well-defined role, vision for course coordination, and set of responsibilities for course coordinators, issues relative to clarity about who is responsible for what tasks and overall influence and efficiency could arise. Having a well-defined course coordinator role and responsibilities can ensure that the work is completed for optimal success. Moreover, the course coordinators should be keenly aware of their role and responsibilities.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
The role and responsibilities for course coordinators are not defined or there are no coordinated courses offered.	The role and responsibilities for course coordinators are informally defined.	The role and responsibilities for course coordinators are becoming more formally defined. Course coordinators are generally aware of these responsibilities.	The role and responsibilities for course coordinators are formally defined. Course coordinators are aware of these responsibilities.	The role and responsibilities for course coordinators is well-defined. The course coordinators are aware of their defined role and responsibilities and they play a role in defining these roles and responsibilities.

CRITERION 5.A2: **The department/introductory mathematics team provides resources to support course coordinators.** This criterion addresses the extent that the department/team supports course coordinators, professionally and financially, to carry out the role of coordination effectively. This support can include creating a professional culture to develop course coordinators. Financial support can be in the form of additional summer funding, salary, course releases, or other financial or time compensation. Incentives can be credit and acknowledgement of role as course coordinator for the purposes of tenure and promotion.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
The department/team does not support course coordinators and does not provide incentives for their role.	The department/team supports course coordinators informally, but there are no established mechanisms for support (e.g., course release) or incentives.	The department/team formally supports course coordinators professionally (e.g., funding for professional development.)	The support provided to course coordinators by the department/team matches the time commitment required for them to fulfill their responsibilities, and includes formal structures or policies to ensure this consistency.	The department/team fully supports course coordinators professionally (e.g., funding for professional development) and financially through mechanisms that allow for sustainability of course coordination and the support provided to course coordinators by the department/team matches the time commitment required for them to fulfill their

				responsibilities, and includes formal structures or policies to ensure this consistency.
CRITERION 5.A3: **Process for onboarding, rotating, and sustaining consistency between course coordinators.** This criterion focuses on whether the department has a process for onboarding, rotating, and ensuring some level of consistency as coordination rotates among faculty.				
(0) Baseline	**(1) Beginning**	**(2) Developing**	**(3) Accomplished**	**(4) Exemplar**
The department/team does not have a process for onboarding or rotating faculty to serve as course coordinators.	The department/team recognizes the need for a process to onboard and rotate course coordinators, but the process is not established yet.	The department/team is establishing a process for onboarding and rotating faculty as course coordinators, but many components of the plan are underdeveloped.	The department/team has established a process for onboarding and rotating faculty as course coordinators but this process varies (e.g., by course, timeline, etc.).	The department/team has an established process for onboarding and rotating faculty as course coordinators and that process is consistent.
CRITERION 5.A4: **Empowering teaching-focused faculty (TFF) to be change agents.** This criterion addresses the need for empowering TFF to be change agents within their role as course coordinators who have the authority to shape the content and pedagogy of the course for which they are coordinating. Their expertise in teaching must be recognized and respected within the department and their voices heard relative to improving student success.				
(0) Baseline	**(1) Beginning**	**(2) Developing**	**(3) Accomplished**	**(4) Exemplar**
TFF are either never assigned to be course coordinators or, when they are, they are not given the same agency and respect as tenured or tenure-track faculty in these positions.	The department/team regularly assigns TFF as course coordinators and gives them some authority over coordinating how the course should be taught.	The department/team regularly assigns TFF as course coordinators and gives them moderate authority to coordinate the various aspects of the course, though their voices are not always heard or ideas respected fully.	The department/team regularly assigns TFF as course coordinators and gives them authority to shape some components of the course, but not all components.	The department/team recognizes and respects the expertise that TFF bring as course coordinators and gives them full authority to shape the content, structure, and pedagogy of the course.
Justification for 5.A1, 5.A2, 5.A3, & 5.A4 Ratings (list separately for each group of courses, if applicable):				

B. COURSE LOGISTICS AND PEDAGOGICAL RESEARCH-BASED PRACTICES

CRITERION 5.B1: **Coordination of course logistics and facilitate the sharing of course materials.** This criterion addresses the extent to which course coordinators support instructors by coordinating course logistics, by providing evidenced based course resources, and by encouraging teaching-focused faculty (TFF) to share resources with one another. By coordinating the course logistics and providing course materials and resources (e.g., common syllabus, developing/maintaining course shell in Learning Management System (LMS), selecting homework tasks, common exams/final), the course coordinator promotes consistency across sections. It is important to emphasize that the aim of providing (optional) course resources is not to take away pedagogical autonomy, but to save faculty time and make teaching the course easier.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
Coordination of course logistics is minimal or inconsistent. There is no effort to encourage sharing of resources among TFF.	Basic coordination of course logistics is provided (e.g., basic course shell in LMS, some selected homework tasks). Some course resources are available, but they may be incomplete or not well-organized. There is limited encouragement for TFF to share resources.	Course logistics are generally well-coordinated (e.g., common syllabus, well-maintained course shell in LMS, selected homework tasks and common exams are provided). There is some encouragement and support for TFF to share resources.	Course logistics are well-coordinated. Comprehensive course resources are mostly aligned with evidence- based practices, are available, and well-organized. TFF are actively encouraged and supported in sharing resources.	Course logistics are effectively coordinated. All course resources are carefully curated,consistently updated, and aligned with evidence- based practices. There is an established mechanism for sharing resources and a strong culture among TFF, facilitated by the course coordinator.

CRITERION 5.B2: **Provide instructional learning (e.g., pedagogical support, course materials, leadership, work with TAs) to implement evidence-based practices in mathematics education.** This criterion addresses the extent to which course coordinators align instructional learning opportunities for teaching-focused faculty (TFF) to improve their instruction, attend to student experience (e.g., awareness of tutoring resources, managing first time college life, growth mindset, metacognition) and ensure students have access to high quality learning experiences. It is important for course coordinators to have an awareness of students' ways of thinking and experiences and to discuss these with instructors, providing professional development to support instructor growth in implementing research-based practices.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
No instructional learning opportunities provided.	Minimal instructional learning opportunities, with minimal attention to student thinking and experiences, provided and rates of instructor participation are low/highly variable.	Basic periodic instructional learning opportunities provided and instructor participation is moderate/moderately variable. Common student ways of thinking and experiences are recognized and discussed with instructors.	Regular instructional support opportunities are provided, including a focus on common student ways of thinking and experiences. Instructor participation is high and consistent over time.	Strong and regular instructional learning opportunities provided. Instructor participation is (nearly) universal and consistent over time.There is a thorough understanding of student ways of thinking and experiences.

Justification for 5.B1 & 5.B2 Ratings (list separately for each group of courses, if applicable):

C. IMPACT OF COURSE COORDINATION

CRITERION 5.C1: **Periodic observation of coordinated classrooms and meetings of instructors.** This criterion addresses both how well the course coordinator keeps track of what is happening in the individual sections through periodic observation of classroom interaction as well as regular meetings with the individual instructors.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
There is no course coordinator for large multi-section courses.	The course coordinator has a clear vision for how the sections should be run and communicates that effectively to the individual instructors.	In addition to the vision that is communicated to the instructors, the course coordinator regularly visits the individual sections and provides feedback to the instructors.	There is recognition by individual instructors of the role of the course coordinator and a strong sense of collegiality among coordinator and instructors in sharing best practices and understanding what is happening within each section.	The department as a whole is aware of how the coordinator and the individual instructors are working collaboratively to improve classroom instruction, and all faculty, including the senior faculty, support and encourage these efforts.

CRITERION 5.C2: **Collecting feedback from instructors and students.** This criterion addresses the need to learn from both students and the individual instructors through observation protocols, surveys, structured interviews with instructors, and focus groups of students about what aspects of course coordination are working well and where improvements could be made.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
There are no formal structures in place for evaluating the effectiveness of the course coordination.	There is some formal mechanism in place for gathering feedback from the instructors in the individual sections.	There is at least one formal mechanism in place for gathering feedback from instructors and a formal means which could be interviews, surveys, or focus groups for gathering feedback from students.	Some form of formal observation protocol is used to understand what is happening in the individual sections, and there are other regular and formal means of collecting feedback from instructors and students.	The results of the formal feedback mechanisms from both instructors and students are made available in aggregated form for consideration and the gathering of feedback from the TFF as a whole.

CRITERION 5.C3: **Collecting and utilizing student outcome data.** This criterion addresses the extent to which the department/introductory mathematics team is aware of student success in the given course including grades and other measures of individual student outcomes, persistence into subsequent courses that rely on what students should carry from this course, and success in these subsequent courses. If there are improvements in these measures, this should be known and celebrated. If these efforts at coordination do not result in improvements, this should be known and serve as a starting point for tweaking or experimenting with the format of the coordination (or other aspects of the instructional system) so as to improve outcomes.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
Data on a given course is neither regularly collected nor analyzed for assessment of student success.	Student grades in the given course are regularly examined and trends are considered.	In addition to grades, other measures of student understanding and confidence are regularly collected and assessed.	In addition to grades and other measures of student understanding, the department/team tracks persistence into and success within subsequent courses.	The department/team tracks, analyzes, and spends time considering the implications of multiple measures that inform how well the specific course fits into the overall instructional progression of which it forms a critical step. This includes identifying significant subpopulations such as women or students from under-resourced schools for whom improvements could be made.
Justification for 5.C1, 5.C2, & 5.C3 Ratings (list separately for each group of courses, if applicable):				

PROJECT EMBER

ELIMINATING MATHEMATICS BARRIERS THROUGH EVIDENCE-BASED REFORMS

PROJECT EMBER: INTRODUCTORY MATHEMATICS SELF-ASSESSMENT
RUBRIC 6 — INSTRUCTOR PROFESSIONAL DEVELOPMENT (5 criteria)

The purpose of this rubric is to assess the extent to which professional development is provided to new and seasoned college mathematics teaching-focused faculty (TFF) across all the various instructional ranks, including graduate student instructors. Professional learning should be supported by the department/introductory mathematics team and institution, and embraced by TFF. Activities for professional learning could include learning communities, conferences/workshops, and other. Finally, the department/team should evaluate the effectiveness of the professional learning opportunities provided to inform future improvements.

In some criteria, there might be a need to hold ratings for graduate student professional development separate from ratings for new faculty professional development. If so, we invite you to make separate notes in the justification section(s) as needed.

Note: As the team works through this rubric, it might be helpful to refer to the Reflection Questions for Guiding Idea Generation section in the Project EMBER Guidebook [https://www.tpsemath.org/project-ember-guidebook]. It might also be wise to capture ideas on your own for possible improvements to introductory mathematics that organically emerge.

A. DEPARTMENT/INTRO MATH TEAM SUPPORT AND PROFESSIONAL DEVELOPMENT

CRITERION 6.A1: **The department/introductory mathematics team offers ongoing, quality professional development for new teaching-focused faculty (TFF), including graduate student instructors.** This criterion addresses the quality of department/team orientation and professional development efforts for new TFF (including graduate students). Professional development programs can range from short (1-2 hour) single sessions to multiple sessions across a semester or even a year. The best professional development allows for a discussion of issues related to teaching and pedagogy. Orientation is focused on sharing core department/team values and instructional practices embraced in the department/team.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
The department/team does not provide any specific TFF orientation activities to new faculty (and graduate students), nor do they provide any information regarding values and practices about teaching in the department.	The department/team offers a mandatory, single-session orientation session around teaching that is required for new TFF (and graduate students). While the session is offered, there is little to no ongoing professional development to support new TFF.	The department/team offers orientation that exceeds the mandatory single session. Some additional non-mandatory opportunities for the development of teaching skills are available for new TFF (and graduate students) through department/team professional development.	The department/team offers multiple, formal orientation and professional development sessions around teaching that are mandatory for new TFF (and graduate students), throughout their first year.	The department/team offers multiple, formal orientation and professional development sessions around teaching that are mandatory for new TFF (and graduate students), throughout their first year. New TFF (and graduate students) have access to (and are encouraged to engage with) individualized support from the department/team to meet their needs in growing as a teacher.

CRITERION 6.A2: **The department/introductory mathematics team offers quality mentoring for new teaching-focused faculty (TFF), including graduate student instructors.** This criterion addresses the quality of department/team mentoring efforts for new TFF (including graduate students). The best TFF mentoring programs assign faculty members from different ranks and perspectives to serve as mentors, often specify the frequency of meetings between mentor and mentee and provide guidance for mentors specifically to discuss issues around teaching performance and pedagogy. For graduate student instructors, either a graduate student coordinator or a course coordinator for the class the graduate student instructor is assigned to would be good options as a mentor.
*Informal mentoring activities include, but are not limited to lunch discussions, department tea/coffee sessions, or other informal gatherings.
**Formal mentoring activities include, but are not limited to seminars, colloquia, workshops, etc.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar

Mentoring for new TFF (and graduate students) of any type is unplanned and not formally organized by the department/team. There are no mentors officially assigned to new TFF, but there could be TFF in the department/team that informally serve as mentors.	The department/team does only one of the following: (1) provides mentoring for new TFF (and graduate students) through planned, informal* activities, **or** (2) assigns an official mentor to TFF.	The department/team does both of the following: (1) provides mentoring for new TFF (and graduate students) through planned, informal* activities, **and** (2) assigns an official mentor to TFF.	The department/team does both of the following: (1) provides mentoring for new TFF (and graduate students) through planned informal* activities and formal** activities, **and** (2) assigns an official mentor to the TFF. The mentor takes an active role in supporting their mentee. The mentor and mentee meet regularly.	The department/team does both of the following: (1) provides mentoring for new TFF (and graduate students) through planned informal* and formal** activities, **and** (2) assigns an official mentor to TFF. The mentor takes an active role in providing teaching-focused support for their mentee (e.g., observes each other's teaching, attend teaching-focused conference-type events together, read articles and discuss). The mentor and mentee meet regularly to discuss teaching and ways to grow in teaching.
CRITERION 6.A3: **The department/introductory mathematics team organizes learning communities to support teaching-focused faculty (TFF), including graduate students, implementation of evidence-based practices.** This criterion is focused on the creation of a community of practice or learning community that provides an opportunity for TFF, including graduate students, to build community and to share and discuss evidence-based practices, data, student work, and active learning tasks. The learning community could also support classroom observations, lesson study, etc. Sharing could include formal opportunities such as Teaching & Learning Center or College-level workshops on mathematics teaching to enhance student learning. Informal sharing opportunities are also important, such as brown bag discussions between and among TFF, including graduate students, about pedagogical approaches.				
(0) Baseline	**(1) Beginning**	**(2) Developing**	**(3) Accomplished**	**(4) Exemplar**
No TFF (or graduate students) participate in a learning community and evidence-based practices are rarely discussed.	There is no learning community, but there are occasional discussions around pedagogy.	At least one learning community has been formed and some TFF participate.	One (or more) learning communities have been formed and many TFF participate.	A learning community has been formed and a significant majority of TFF (and graduate students) participate in discussions about teaching and share their work with each other.
Justification for 6.A1, 6.A2, 6.A3 Ratings (for new TFF): **Justification for 6.A1, 6.A2, 6.A3 Ratings (for new graduate students, if necessary/applicable):**				

B. TEACHING-FOCUSED FACULTY ENGAGEMENT IN PROFESSIONAL DEVELOPMENT

CRITERION 6.B1: **Teaching-focused faculty (TFF) engagement at conferences or other professional development opportunities in mathematics education.** This criterion addresses the degree to which TFF participates or engages with their institution's opportunities for ongoing professional development related to improving teaching and learning in introductory mathematics education. Professional development for TFF, including graduate students, may take multiple forms including 1) day-long or week-long workshops, 2) attending professional discipline-based meetings, or 3) spending time with an expert in the area. Examples of events that are focused on mathematics education and its reform include JMM, AMS, ASA, MAA (MathFest, RUME), etc. This is not an exhaustive list as there are many other regional and national conferences, meetings, and workshops focused on mathematics undergraduate education, emergent curricula, technology, and work-place competencies.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
TFF do not attend conferences or workshops related to reform efforts in undergraduate STEM education.	A small number of TFF actively participate in national conferences and other professional development opportunities focused on curricular reform and improving teaching and learning.	Some TFF actively participate in national conferences and other professional development opportunities focused on curricular reform and improving teaching and learning.	Many TFF actively participate in national conferences and other professional development opportunities focused on curricular reform and improving teaching and learning.	A significant majority of TFF regularly participate in national conferences and other professional development opportunities focused on curricular reform and improving teaching and learning, and participate in dialogue on STEM reform.

Justification for 6.B1 Rating:

C. EFFECTIVENESS OF DEPARTMENTAL SUPPORT AND PROFESSIONAL DEVELOPMENT

CRITERION 6.C1: **The department/introductory mathematics team evaluates the effectiveness of professional development activities.** This criterion addresses the degree to which the department/team considers the effectiveness of the systems in place to support TFF, including graduate students, professional growth related to teaching. This could include a variety of mechanisms for evaluating effectiveness, such as conducting peer or mentor observations of teaching, reviewing student feedback gathered specifically for the purpose of evaluating teaching (in addition to or separate from the end-of-term student evaluations required for all classes by the university or department/team, analyzing student grades, surveying faculty (or graduate students) after participating in professional development or learning community, etc. The department/team uses this data to help inform changes to ongoing professional development activities.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
No process for reviewing the effectiveness of professional development activities are used.	Some informal or ad hoc processes are in place for reviewing the effectiveness of professional development activities. Although mechanisms exist to collect and examine data, it is not data intended for the purpose of evaluating professional development activities for improvements in teaching.	Basic processes are established for reviewing the effectiveness of professional development activities. While the department/team may be examining existing data, they also collect data for the purpose of evaluating professional development activities. However, these efforts are limited in scope and lack a clear framework for analyzing results or making improvements.	A comprehensive system to consider the effectiveness of professional development activities is in place. The department/team uses a robust, multi-faceted approach for the purpose of evaluating professional development activities. However, data is not leveraged to make improvements to the professional development activities.	A comprehensive system to consider the effectiveness of professional development activities is in place. The department/team uses a robust, multi-faceted approach for the purpose of evaluating professional development activities. Data is used to strategically refine and enhance the effectiveness of professional development activities.

Justification for 6.C1 Rating:

PROJECT EMBER

ELIMINATING MATHEMATICS BARRIERS
THROUGH EVIDENCE-BASED REFORMS

PROJECT EMBER: INTRODUCTORY MATHEMATICS SELF-ASSESSMENT
RUBRIC 7 — INSTRUCTION & ASSESSMENT OF STUDENT LEARNING (9 criteria)

The purpose of this rubric is to assess the extent to which teaching-focused faculty (TFF) use a variety of instructional strategies that reflect the results of research to enhance student learning and the extent to which faculty use the results from the ongoing assessment of student learning to guide instruction. Effective mathematics instruction requires a variety of resources, materials, technology, and forms of assessment of student learning to guide instruction in an effort to increase student success in mathematics. Using multiple strategies in the classroom will increase the level of engagement of students and open opportunities for more students to be actively involved in the learning of mathematics. Formative and summative assessment of student learning of mathematics should be aligned with curriculum and instruction to support student learning.

Note: As the team works through this rubric, it might be helpful to refer to the Reflection Questions for Guiding Idea Generation section in the Project EMBER Guidebook [https://www.tpsemath.org/project-ember-guidebook]. It might also be wise to capture ideas on your own for possible improvements to introductory mathematics that organically emerge.

A. PEDAGOGY AND THE CLASSROOM

CRITERION 7.A1: Focus instruction on active learning and foster student engagement. Instructors leverage active learning instructional practices (Laursen & Rasmussen, 2019) that promote deep mathematical and statistical thinking in students, nurture student-to-student interaction, allow instructors to use student thinking to guide instruction, and call attention to equitable and inclusive practices. Widespread implementation of high-quality active learning can help reduce or eliminate achievement gaps in STEM courses and promote equity in higher education.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
Active learning strategies are not used by instructors in the department/team.	Active learning strategies, such as think-pair-share, table talks, clickers, etc. that are entry level and most accessible are leveraged when teaching courses in the department/team.	Active learning strategies, such as assigning students tasks/worksheets to complete in groups during class, etc. that are intermediate level are leveraged when teaching courses in the department/team.	Active learning strategies, such as using guided discovery, group-worthy tasks, student presentations, etc. that are more advanced and geared towards using student thinking to guide instruction are leveraged when teaching courses in the department/team.	Active learning strategies, such as engaging students in deep thinking about mathematics, peer-to-peer interaction, instructor attention to and use of student thinking, and instructor use of inclusive teaching practices that are expert level are leveraged when teaching courses in the department/team.

CRITERION 7.A2: **Mathematical discourse and student collaboration**. This criterion is focused on the level of student engagement and mathematical discourse being supported and valued in the classroom. The discourse should be mathematical in nature and promote the sharing of ideas, processes, approaches, and strategies for solving problems. Through mathematical discourse, students should engage in peer-to-peer interaction as they collaborate together to share ideas, build upon each other's ideas and thinking, and support each other in their learning.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
Students do not have opportunities to engage in mathematical discourse or collaborate with other students in courses as time in class is solely focused on direct instruction.	Students have minimal opportunities to engage in mathematical discourse or collaborate with other students as time in class is mostly focused on direct instruction.	Students have some opportunities to engage in mathematical discourse and collaborate with other students as class time includes a roughly even split between direct instruction and student collaboration.	Students have many opportunities to engage in mathematical discourse and collaborate with other students. Student thinking is sometimes shared publicly and used to guide instruction. While some direct instruction is used, class time is more heavily focused on student collaboration.	Students have significant opportunities to engage in mathematical discourse and collaborate with other students in support of their learning. Students work collaboratively (making ideas public, using vertical whiteboards, etc.) and all students are individually held accountable for understanding the mathematics concepts.

CRITERION 7.A3: **Teaching with technology.** Instructors use appropriate technology to model mathematical and statistical ideas which promote deeper student learning. Teaching-focused faculty (TFF) encourage students to engage with technology both inside and outside of the classroom to foster their learning.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
TFF do not use appropriate technology in the classroom. Students are not allowed to use technology on assessments.	TFF use appropriate technology in their teaching, but the focus of use is on calculations and procedures rather than using technology for deepening learning. Students are not allowed to use technology on assessments.	TFF use appropriate technology in their teaching with a mixed focus on calculations and procedures coupled with some use of technology for deepening learning, but the use is limited in scope and students are not allowed to use technology on assessments.	TFF use appropriate technology in their teaching with an emphasis more on deepening learning and less on calculations and procedures. Students are encouraged to use technology outside of the classroom and they are allowed to use technology on assessments.	TFF use (and encourage students to use) appropriate technology, such as graphing calculators, Desmos, R, Wolfram Alpha, etc., with an extreme emphasis on deepening learning. Students are encouraged to use technology inside and outside of the classroom and they are allowed to use technology on assessments.
Justification for 7.A1, 7.A2, & 7.A3 Ratings:				

B. ASSESSMENT AND GRADING

CRITERION 7.B1: Effective use of formative assessments to measure student learning. Formative assessments are low stakes assessments, typically ungraded, used for determining learning rather than determining grades. Examples include pre-class preparatory quizzes, in-class student problem solving, student response system questions, online homework problem sets, online homework platforms, and self assessments. These should be built on a clear understanding of where students are likely to have the greatest difficulty. They should help each student as well as teaching-focused faculty (TFF)identify concepts and practices that require additional work or support. These formative assessments should be designed to inform and guide instruction, allow for students to get immediate and near-immediate feedback, and provide opportunities for students to demonstrate their knowledge in a variety of ways (e.g., showcase thinking on whiteboards, low-stakes assignments, projects).

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
No TFF use formative assessments to measure student learning.	Some TFF are beginning to use formative assessments and are sharing their practices with others.	Several TFF use formative assessments in their courses, but they typically do not use them to guide instruction. TFF actively promote the use of formative assessment by providing examples and assistance.	Many TFF use formative assessments in their courses and use them to guide instruction to a certain extent. They use the assessments to determine alternative ways to approach mathematics to support student success. TFF readily share their practices with others.	The majority of TFF use formative assessments in their courses and use them regularly to guide instruction. They use the assessments frequently to determine alternative ways to approach mathematics to support student success. TFF readily share their practices with others.

CRITERION 7.B2: Effective use of summative assessments to measure student learning. Summative assessments must be clearly tied to the learning outcomes that have been established for the course. They must serve two purposes. They should demonstrate the achievements of each student, but they also must serve to guide course changes so as to improve student learning in the future. Overall, the focus on summative assessments should be on measuring student learning and less about assigning grades (though this is a required part of teaching).

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
Each instructor creates their own summative assessments with little or no attempt to align these with departmental/team learning outcomes.	Instructors coordinate their summative assessments with some attention to departmental/team learning outcomes.	Summative assessments are coordinated with careful attention to the desired departmental/team learning outcomes.	There is a departmental/team procedure for assessing summative assessments to ensure alignment with learning outcomes and for providing feedback to instructors on areas where student learning is lagging.	Summative assessments are well aligned with departmental/team learning outcomes and there is a regular procedure for using them to identify topics and concepts where students are struggling.

CRITERION 7.B3: Clarity of learning outcomes and relationship to the MAA's CUPM Curriculum Guide and Instructional Practices Guide. The department/introductory mathematics team has a clear set of learning outcomes for each introductory course. The appropriate documents such as course syllabi, outlines, and descriptions are collected and evaluated by chair/colleagues/peer instructors for clarity and alignment with the student learning outcomes.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
There are no set departmentally/team learning outcomes for the introductory courses.	The department/team has established learning outcomes for introductory courses, but little or nothing is done to monitor instructional alignment with these outcomes.	The department/team has begun the process of collecting syllabi, outlines, and course descriptions, but there is no effective process for evaluating them.	The department/team regularly evaluates syllabi, outlines, and course descriptions to assess alignment with learning outcomes.	The department/team regularly evaluates syllabi, outlines, and course descriptions to assess alignment with learning outcomes and provides useful feedback to instructors.

CRITERION 7.B4: Alternative grading aligned with innovative teaching. Alternative grading strategies that are designed to measure student learning help promote authentic learning and engagement. When using alternative grading strategies, students are provided meaningful feedback where they have opportunities to loop back to the content to demonstrate learning over time so teaching-focused faculty (TFF) can assess a progression of learning. Additionally, instructors should evaluate what they value by employing grading practices that are well-aligned to the innovative teaching being implemented in the class. Such practices include, but are not limited to, allowing students to do exam corrections, retakes, or incorporating standards-based grading (or equivalent alternative grading methodologies).

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
The focus of assessing knowledge leverages only traditional grading practices where a progression of learning is not considered. Instead students are graded only on assessments given at fixed times with no opportunity to re-demonstrate knowledge.	The focus of assessing knowledge leverages mostly traditional grading practices but some TFF have begun weaving more non-traditional practices, such as allowing students to do exam corrections or retakes without penalty. Introductory mathematics students' course grades are not significantly impacted by their ability to demonstrate their knowledge through these processes.	There is a balance between 1) grading practices (traditional and non-traditional) within a given introductory mathematics course as well as 2) the number of TFF who incorporate the mix of grading strategies. Introductory mathematics students' course grades are somewhat impacted by their ability to demonstrate their knowledge through these processes.	There is a mix between 1) grading practices (traditional and non-traditional) as well as 2) the number of TFF who incorporate the mix of grading strategies with a heavier lean towards non-traditional practices used by more than half of TFF. The focus is on students' progression of learning, and students have some opportunities to demonstrate their knowledge in a variety of ways. Introductory mathematics students' course grades are significantly impacted by their ability to demonstrate their knowledge through these processes.	Alternative grading strategies are widely implemented, accepted, and a celebrated department/team practice in introductory mathematics. In introductory mathematics courses where innovative teaching practices are implemented (e.g., active learning, inquiry-based learning, etc.), students are also being evaluated in ways that align with these practices. The focus is on students' progression of learning over time, and students have multiple opportunities to demonstrate their knowledge in a variety of ways. Introductory mathematics students' course grades are significantly impacted by their ability to demonstrate their knowledge through these processes.

Justification for 7.B1, 7.B2, 7.B3, & 7.B4 Ratings:

C. STUDENT HIGHER LEVEL LEARNING

CRITERION 7.C1: **Opportunities for inquiry, exploration, and generalization in courses.** This criterion is focused on the degree to which inquiry-based learning is incorporated into courses. In other words, to what degree do students have the opportunity to engage in inductive and deductive reasoning, analyze data, craft and test hypotheses, and create mathematical models. Another key point here is that class time should not be dedicated solely to presentation of facts, but instead should expose students to mathematical thinking (conjecturing, justifying, generalizing, finding examples and non-examples, modeling, and problem solving) and statistical reasoning (data collection, hypothesis generation, model generation, hypothesis testing, data analysis, and drawing conclusions based on probability).

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
Courses do not provide opportunities for inquiry, exploration, and generalization; students have no opportunity to experience the math before formalizing ideas.	Courses provide minimal opportunities for inquiry, exploration, and generalization; on occasion, students have opportunities to experience the math before formalizing ideas but teaching is still mostly on presenting facts rather than on students' mathematical thinking.	Courses provide some opportunities for inquiry, exploration, and generalization; students have some opportunities to experience the math before formalizing ideas with minimal teaching focused on eliciting student thinking to guide instruction.	Courses provide many opportunities for inquiry, exploration, and generalization; students have many opportunities to experience the math before formalizing ideas with some teaching focused on eliciting student thinking to guide instruction.	Courses provide significant opportunities for inquiry, exploration, and generalization; students have significant opportunities to experience the math before formalizing ideas with all teaching focused on eliciting student thinking to guide instruction. This way of teaching is the norm in all courses and instructors are guiding instruction based on student experiences and thinking.

CRITERION 7.C2: **Student higher-order cognitive processes**. This criterion is focused on the type of thinking required of students and whether assignments and assessments are designed to give students adequate practice, particularly in developing higher order cognitive skills. A cognitively demanding task is not working with more complex symbolic expressions, for example, but rather is a task that requires critical thinking and both excites and motivates students to solve problems. The tasks go beyond doing and understanding mathematics and move towards student ownership of the mathematics.

(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar

Assignments and assessments across the curriculum are focused on low-level cognitive processes.	Assignments and assessments across the curriculum are typically at lower cognitive levels, but a few may require higher-order cognitive processes.	Some assignments and assessments across the curriculum require higher-order cognitive processes.	Many assignments and assessments across the curriculum require higher-order cognitive processes.	Student work at higher cognitive levels is the norm across the curriculum, and instructors are adept at developing assignments and assessments that require higher-order cognitive processes.
Justification for 7.C1 & 7.C2 Ratings:				