Please read the entire Introduction before completing the Rubric

The Teaching for PROWESS (TfP) Vision & Transformation Catalyst Tool* is a diagnostic tool designed to be used in a self-study to evaluate the implementation of the recommendations of the AMATYC Standards (referring to *Crossroads in Mathematics*, *Beyond Crossroads*, and *IMPACT* in mathematics departments. The work is based on the extensive work of Partnership for Undergraduate Life Science Education (PULSE)** which was focused on Biology in 4-year institutions. They have been modified based on the features expected in a 2-year college math department that has fully implemented all of the AMATYC recommendations. They are meant as tools to highlight the areas where departments stand out and areas where departments have made less progress.

The complete Teaching for PROWESS Vision & Transformation Catalyst Tool contains 8 rubrics**:**
1) Student Learning and the Learning Environment, 2) Instruction, 3) Curriculum and Program Development, 4) Assessment of Student Learning, 5) Diversity, Equity, and Inclusion, 6) Professionalism, 7) Climate for Transformation, and 8) Snapshot.

Terminology: The rubrics can be used to evaluate individual departments, or a division composed of mathematics faculty (either full-time or part-time) which will be referred to as 'departments' in this document. The use of the term 'faculty' throughout the rubrics is meant as a generic term for the range of possible titles for all those who are instructors in any course that is part of the department being evaluated.

Procedure: Once a department chooses an area, or areas, they would like to examine, the faculty should then individually determine scores for the rubrics. Each criterion begins with a **CONTEXT** section that should be read *prior to* reading the criterion's descriptors. Once a score for a criterion is determined it is important to document the justification in the appropriate section of the table. After the individual results are completed, the department should determine and report a consensus score for each criterion. For more information and suggestions on completing this process, refer to the Rubric FAQs on the teachingforprowess.wordpress.com website.

Rubric IV - Assessment of Student Learning (15 criteria)

This rubric assesses the extent to which the mathematics faculty use the results from the ongoing assessment of student learning of mathematics to improve curricula, materials, and teaching methods. Formative and summative assessment of student learning of mathematics should be aligned with curriculum and instruction to support student learning. Effective assessment practices include the documentation of student learning at the class, course, and program level. The data should be disaggregated to find any inequities of opportunity. The use of the term 'program' refers to a program of study that offers students a choice of transferable gateway college-level mathematics courses aligned to their program of study, such as a statistics pathway for students pursuing social and health sciences, a quantitative reasoning/literacy pathway tailored to humanities or general education students, and an algebra-intensive pathway for students majoring in science, technology, engineering, and mathematics (STEM). These course and program reviews and the subsequent revisions should reflect the department's own analysis of student achievement, the latest research findings, and the informed practice of the mathematics community. Categories include: A) Course Level Assessment and B) Program Level Assessment.

A. COURSE LEVEL ASSESSMENT

CRITERION A1: Clarity of learning outcomes and relationship to AMATYC's Standards for Content and Standards for Intellectual Development

CONTEXT: This criterion should be fairly self-explanatory. Appropriate documents (such as course syllabi, outlines, descriptions, etc.) should be collected and evaluated by chair/colleagues/peer instructors for clarity and alignment of student learning outcomes with AMATYC's Standards for Content and Standards for Intellectual Development.

A		(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
1	**Clarity of learning outcomes and relationship to AMATYC's Standards for Content and Standards for Intellectual Development**	Learning outcomes are not related to content and intellectual development standards	Learning outcomes are not clearly related to content and intellectual development standards	Learning outcomes are somewhat related to content and intellectual development standards	Learning outcomes are well written and are mostly related to content and intellectual development standards	Learning outcomes are well written and clearly related to content and intellectual development standards

Justification A1 (Required):

A. COURSE LEVEL ASSESSMENT

CRITERION A2: Presentation, definition, and discussion of learning outcomes with students

CONTEXT: This criterion addresses the concern that students often do not understand the "education-speak" sometimes used to describe Learning Outcomes. Colleagues/peer instructors should be able to note the integration of reminders of the course learning outcomes when visiting/reviewing a course.

A		(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
2	**Presentation, definition, and discussion of learning outcomes with students**	Learning outcomes are not explicit	Learning outcomes are explicitly defined, but they are not discussed with students	Learning outcomes are explicitly defined with an explanation of how outcomes will be measured, but they are not discussed with students	Learning outcomes are explicitly defined with an explanation of how outcomes will be measured; outcomes and their measurement are discussed with students at least once during the course	Learning outcomes are explicitly defined with an explanation of how outcomes will be measured; outcomes and their measurement are discussed with students frequently throughout the course

Justification A2 (Required):

A. COURSE LEVEL ASSESSMENT

CRITERION A3: Summative assessments are linked to learning outcomes and grading is done using a data-gathering paradigm

CONTEXT*:* This criterion requires careful articulation of course-level learning outcomes and intentional selection or development of assessments to measure student achievement of the outcomes. A major goal of any assessment program should be to gain information that can be used to improve student learning in the future; a second important goal would be demonstration of achievement for specific students. For a score of three or four below, it is essential that assessments are carefully mapped to the outcomes (rather than generically appropriate for the course such as a standardized test used across many sections that provides broad information about student knowledge but is difficult to use for specific course improvements). Grades should be based on what a student knows and can do with respect to student learning outcomes at the time grades are issued. A low score on an assessment early in the semester should not result in a low grade if the student demonstrates mastery at the time grades are issued.

The following resources provide research on implementing this criterion: *Aligning Teaching and Assessing to Course Outcomes*; *How to use (five) curriculum design principles to align authentic learning environments, assessment, students' approaches to thinking and learning outcomes*; *Building Thinking Classrooms* (Chapter 14).

A		(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
3	**Summative assessments are linked to learning outcomes and grading is done using a data-gathering paradigm**	Summative assessments are not linked to learning outcomes; does not use data-gathering paradigm in determining grades	Some courses have summative assessments that measure learning outcome achievement; some courses use the data-gathering paradigm in determining grades	Many courses have summative assessments that measure learning outcome achievement; some courses use the data-gathering paradigm in determining grades	Many of courses have summative assessments that measure learning outcome achievement; many use the data-gathering paradigm in determining grades	Most courses have summative assessments that measure learning outcome achievement; most use the data-gathering paradigm in determining grades

Justification A3 (Required):

A. COURSE LEVEL ASSESSMENT

CRITERION A4: Inclusion of frequent formative assessments with teacher feedback to students

CONTEXT*: Formative assessments are low stakes assessments, typically ungraded, used for determining learning rather than determining grades, for example, pre-class preparatory quizzes, in-class student problem solving, student response system questions, self assessments, etc. Typically, formative approaches are used by the instructor to adapt their teaching strategy based on student progress. Formative assessment should also be used to inform students of what they have mastered and what they still need to learn. Use of formative assessment should assist students in the ownership of their learning.

The following resources provide research on implementing this criterion: *Formative Assessment in Mathematics*, *Building Thinking Classrooms (Chapter 13)*.

A		(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
4	**Inclusion of frequent formative assessments with teacher feedback to students**	Formative assessments are not given	Formative assessments are given, but students do not receive feedback	Some courses have formative assessments that measure learning outcome achievement and students receive feedback from instructors on what they learned	Many courses have formative assessments that measure learning outcome achievement and students receive feedback from instructors on what they learned	The majority of courses have formative assessments that measure learning outcome achievement and students receive feedback from instructors on what they learned

Justification A4 (Required):

A. COURSE LEVEL ASSESSMENT

CRITERION A5: Use of externally-developed assessments where available and appropriate

CONTEXT: This criterion addresses the use of assessment tools to measure learning outcome achievement. Externally-developed tools can include, but are not limited to, validated concept inventories, national society-generated exit exams, and critical thinking assessments, such as the Critical Thinking Assessment Test (CAT) (https://www.tntech.edu/ cat) developed with NSF support.

A		(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
5	**Use of instructor externally-developed assessments where available and appropriate**	Externally-developed assessments are not used	Externally-developed assessments are used in some courses to measure learning outcome achievement	Externally-developed assessments are used in many courses to measure learning outcome achievement	Externally-developed assessments are used in the majority of courses to measure learning outcome achievement	Externally-developed assessments are used in the majority of courses to measure learning outcome achievement as part of a coherent evidence-based assessment plan

Justification A5 (Required):

A. COURSE LEVEL ASSESSMENT

CRITERION A6: Assessment of the quantity and quality of active learning used in courses

CONTEXT: This criterion measures whether the department assesses 1) how often active learning is used in mathematics courses and 2) the effect of using active learning on student success in the courses. An analysis of course syllabi that looks at the types of activities used and the types of assessment of student learning used can be used to get a general sense of the departmental norm with respect to active learning. Student success rates prior to a focus on active learning can be compared with success rates after introducing more active learning. Data should be disseminated to and discussed by all mathematics instructors. These activities should be supplemented using classroom observations for a sample of courses. The Observation Protocol for Active Learning (OPAL) created by Teaching for PROWESS can be used for these classroom observations. A variety of other instruments for classroom observation to assess this criterion are currently in use, for example, The Classroom Observation Protocol for Undergraduate STEM (COPUS) and the Reformed Teaching Observation Protocol (RTOP). *Transformational Change Efforts: Student Engagement in Mathematics through an Institutional Network for Active Learning* is a SEMINAL handbook designed to help mathematics departments use active learning to improve student outcomes.

A		(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
6	**Assessment of the quantity and quality of active learning used in courses**	There is no assessment of the quantity and quality of active learning in use	Plans are in place for assessing the quantity and quality of active learning, but assessment is limited to a few sections or courses	An assessment of the quantity and quality of active learning and the effect on student success is completed for some courses.	An assessment of the quantity and quantity of active learning and the effect on student success is completed for many courses.	An assessment of the quantity and quality of active learning and the effect on student success is completed for most courses.

Justification A6 (Required):

A. COURSE LEVEL ASSESSMENT

CRITERION A7: Use of data on student prior knowledge to revise courses

CONTEXT*:* This criterion addresses deployment of instruments to gauge student prior knowledge and using this information to revise courses. Determining prior knowledge for individual courses can be accomplished by concept inventory or placement tests. The Precalculus Concept Assessment (PCA), the Calculus Concept Inventory (CCI), the Statistics Concept Inventory (SCI) are examples of such assessments currently available. The Emergent Algebra Concept Inventory (EACI) is an algebra inventory under development. Course revision may include changes to course content or instructional strategies, or the need for co-requisites courses.

A		(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
7	**Use of data on student prior knowledge to revise courses**	Evidence of student prior knowledge is not gathered	Evidence of student prior knowledge is gathered, but rarely used to inform course changes	Evidence of student prior knowledge is gathered and occasionally used to inform course changes	Evidence of student prior knowledge is gathered and often used to inform course changes	Evidence of student prior knowledge is formally gathered and as a result, most instructors regularly revise their courses in in order to maximize learning

Justification A7 (Required):

B. PROGRAM LEVEL ASSESSMENT

CRITERION B1: Assessment of the AMATYC Standards for Content at the program level

CONTEXT: This criterion seeks to specifically address the integration of the *AMATYC* Standards for Content into a major or program. A suggested method is to analyze the trajectory of mathematics content included across the program (by using course outlines, course syllabi, course descriptions, and program outcomes) to inform departments about the integration of the Standards for Content.

B		(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
1	**Assessment of the AMATYC Standards for Content at the program level**	Integration of Standards for Content not assessed at the program level	Integration of 1 or 2 of the Standards for Content assessed at the program level	Integration of 3 or 4 of the Standards for Content assessed at the program level	Integration of 5 or 6 Standards for Content assessed at the program level	Integration of all of the Standards for Content assessed at the program level

Justification B1 (Required):

B. PROGRAM LEVEL ASSESSMENT

CRITERION B2: Assessment of the AMATYC Standards for Intellectual Development at the program level

CONTEXT: This criterion seeks to specifically address the integration of the Standards for Intellectual Development into a program. A suggested method is to include a capstone project as evidence of students' application of the Standards for Intellectual Development. Another method is to analyze if the use of intellectual skills are integrated in the program (by using course outlines, course syllabi, course descriptions, and program outcomes).

B		(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
2	**Assessment of the AMATYC Standards for Intellectual Development at the program level**	Standards for Intellectual Development not assessed at the program level	Integration of 1 or 2 Standards for Intellectual Development assessed at the program level	Integration of 3 or 4 Standards for Intellectual Development assessed at the program level	Integration of 5 or 6 Standards for Intellectual Development assessed at the program level	Integration of 7 or more Standards for Intellectual Development assessed at the program level

Justification B2 (Required):

B. PROGRAM LEVEL ASSESSMENT

CRITERION B3: Collection and analysis of data on program effectiveness

CONTEXT: The collected data should include both direct and indirect measures. Direct measures of student learning may include comprehensive exam/concept inventory scores for graduating students, portfolios, capstone projects, oral examinations, or exit interviews. Indirect measures may include course grades, measures of the number of students that transfer to a 4-year college or obtain STEM-related employment, success rates of students at transfer institutions, or comparison of enrollment numbers over time. A fairly comprehensive list of direct and indirect measures of student learning can be found at Examples of Direct and Indirect Measures. The data should be disaggregated to determine how well the program is serving underrepresented groups. Data may be analyzed in collaboration with an office of institutional research, but faculty members take ownership of these data when they analyze direct student data as well.

B		(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
3	**Collection and analysis of data on program effectiveness**	Program effectiveness is not evaluated	Program effectiveness is measured only through analysis of indirect data	Program effectiveness is measured through analysis of indirect data and one source of direct data	Program effectiveness is measured through analysis of indirect data and 2-3 sources of direct data	Program effectiveness is measured through analysis of indirect data and 4 or more sources of direct data

Justification B3 (Required):

B. PROGRAM LEVEL ASSESSMENT

CRITERION B4: Use of analyzed data on program effectiveness

CONTEXT: This is a follow-up to criterion B3. This criterion speaks to what extent the analyzed program effectiveness data is used to strengthen the program and encourages departments to consider collecting and analyzing program effectiveness data to inform program revision.

B		(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
4	**Use of analyzed data on program effectiveness**	Program is not revised in response to data on program effectiveness	Program revision occurs in response to indirect data on program effectiveness only	Program revision occurs in response to indirect data and one source of direct data on program effectiveness	Program revision occurs in response to indirect data and 2-3 sources of direct data on program effectiveness	Program revision occurs in response to indirect data and 4 or more sources of direct data on program effectiveness

Justification B4 (Required):

B. PROGRAM LEVEL ASSESSMENT

CRITERION B5: Measurement of retention for different student populations

CONTEXT: This criterion is focused on retention of all students who enter the program. Specific student populations that often are differentially retained would include traditionally Under-Represented Groups (URGs). Retention of students throughout the program should be included after one course in the department (i.e., how many students go on to take a second course), two courses, 3-5 courses, and majors. The purpose of this criterion is to understand where in your curriculum students most often move away from the study of mathematics or other STEM disciplines. The data should include a measure of the climate experienced by these students. Examples of tools to measure climate include the Classroom Community Scale; the College Student Mentoring Scale (CSMS); and the What's your STEMspiration? survey.

B		(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
5	**Measurement of retention for different student populations**	Retention is not evaluated	Retention is measured only with enrollment figures	Retention is measured with enrollment figures as well as with attention to student populations of special interest	Retention is measured with enrollment figures with attention to student populations of special interest and also includes students at critical transition points	Retention is measured with enrollment figures with attention to student populations of special interest and also includes students at critical transition points; data are critically analyzed to pinpoint areas of retention focus

Justification B5 (Required):

B. PROGRAM LEVEL ASSESSMENT

CRITERION B6: Use of retention data to improve student persistence

CONTEXT: This criterion is related to the degree to which the data in B1, B2, B3, and B5 above are used to improve student persistence. For scores of 3 or 4, written departmental or institutional plans to increase the persistence of students in mathematics or other STEM disciplines would be important. Because persistence is adversely affected by the time it takes students to complete the mathematics courses in a STEM program, the department should consider if measures were undertaken to accelerate students through the mathematics required. Examples of accelerated mathematics programs of study include corequisite courses (see definition in Chapter 6 of *IMPACT*) and flex-start/fast-track (i.e., 6-week, 8-week, 10-week).

B		(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
6	**Use of retention data to improve student persistence**	Data are not used	Data are collected, but are not used in any clear way	Data are used in a coordinated capacity to improve persistence	Data are used in a coordinated and consistent way across the areas of the program to improve persistence	Data are used in a coordinated and consistent way with strategies in place for continuous improvement

Justification B6 (Required):

B. PROGRAM LEVEL ASSESSMENT

CRITERION B7: Assessment of learning in different student populations

CONTEXT: Analysis of outcomes for particular groups of students such as women, underrepresented minorities (URM), or socioeconomically challenged student populations can be very different from the majority of the class. Roadblocks to success for particular at-risk populations can be identified through more sophisticated analysis and used to intervene to alleviate these roadblocks. The data collection should address imposter syndrome, use of negative stereotypes by instructors, differences in expectations, etc. This type of evaluation can be aided by working with a Discipline Based Educational Researcher (DBER) who can provide the statistical analyses necessary to tease out the differences and causes/effects. Departments could also collaborate with Institutional Research Offices or other disciplines to examine the root causes of the challenges sub-populations of students struggle to overcome. A score of 4 would suggest a department was regularly engaged in such discovery and revision of their curriculum to alleviate challenges that impede student success for all populations.

B		(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
7	**Assessment of learning in different student populations**	No effort made to identify differences	Assessments provide information on achievement differences; the information is not used to develop strategies to address achievement gaps	Assessments provide information on achievement differences; information discussed and used informally to address achievement gaps	Assessments provide information on achievement differences; specific interventions developed to address achievement gaps	Assessments provide information on achievement differences; interventions developed to address achievement gaps; the impact of interventions on the gaps is measured for continuous improvement

Justification B7 (Required):

B. PROGRAM LEVEL ASSESSMENT

CRITERION B8: Use of data on student placement (based on student preparedness) and career-choice interests in program revision

CONTEXT: This criterion is meant to assess the level of consideration used by a department to inform changes to courses and curricula in response to student preparedness and interests. To do this, programs must first collect college preparedness and interest data (score of 1) and then use that data to revise the curriculum (scores of 2-4). The AMATYC Initial Placement of Students into the Mathematics Curriculum Position Statement provides guidance for developing and assessing policies for placement.

B		(0) Baseline	(1) Beginning	(2) Developing	(3) Accomplished	(4) Exemplar
8	**Use of data on student placement (based upon student preparedness) and career-choice interests in program revision**	Student placement and interests data are not collected	Student placement and interests data are collected, but are not used to inform program revisions	Student placement and interests data are collected and discussed informally, but inconsistently used to inform program revisions	Student placement and interests data are collected, discussed formally, and intermittently used to inform program revisions	Student placement and interests data are collected, discussed formally on a regularly established basis, and used to inform program revisions

Justification B8 (Required):