Teaching for PROWESS Vision and Change Rubrics Summaries

The Teaching for PROWESS (TfP) Vision & Change 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 & Change Catalyst Tool contains 7 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, and 7) Climate for Change.

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.

*An initiative launched by the National Science Foundation (NSF), the Howard Hughes Medical Institute (HHMI), and the National Institute for General Medical Sciences (NIGMS/NIH).

The TfP Rubrics are to be used to report *consensus scores*, not average scores, which result in skewed scores, particularly in small departments. Many departments develop consensus by completing the rubrics during department meetings to discuss differences in scores and come to agreement among department members.

This summary document is intended to give members of a department a basic understanding of each of the rubrics to aid in determining which rubrics the department would like to use. Each rubric section begins with a summary of the intent of the rubric (click on the arrow to expand) and is followed by 8-16 criteria. Further explanation (Context) for each criterion is available by clicking on the criterion. Each rubric is rated on a 0-4 scale. For complete details of each rating, please see the full rubric documents.

Rubric I – Student Learning and the Learning Environment (8 criteria)

Summary

This rubric assesses the extent to which mathematics faculty and their institutions create an environment that optimizes the learning of mathematics for all students. Two-year colleges serve a student body with varied characteristics and academic needs. Each student is entitled to the best educational experiences and opportunities available regardless of age, gender, sexual orientation, race and cultural differences, socio-economic factors, physical and cognitive abilities, or pre-college experiences. Creating a learning environment that maximizes student learning in mathematics and responds to the needs of all students requires the active involvement of every faculty member and each component of the institution. The latest educational research should be used in designing the learning environment. Categories include: A) Learning Environment and B) Resources and Support.

Rubric II – Instruction (14 criteria)

Summary

This rubric assesses the extent to which mathematics faculty use a variety of instructional strategies that reflect the results of research to enhance student learning. Effective mathematics instruction requires a variety of resources, materials, technology, and delivery systems that take into account students' different learning styles and instructors' different teaching styles. 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. Categories include: A) Pedagogy, B) Student Higher Level Learning, and C) Learning Activities Beyond the Classroom.

Part A – Pedagogy

The Standards for Pedagogy presented in the *Crossroads in Mathematics* are compatible with the constructivist point of view. They recommend the use of instructional strategies that provide for student activity and student-constructed knowledge. Furthermore, the standards are in agreement with the instructional recommendations contained in *Professional Standards for Teaching Mathematics* (NCTM, 1991). Sentences and phrases in italics show changes based on new knowledge since *Crossroads* was published in 1995. More detail can be found in Chapter 2 of the document.

Criterion A1: Teaching and Technology
Criterion A2: Active and Collaborative Learning
Criterion A3: Connecting with Other Experiences
Criterion A4: Multiple Approaches and Representations
Criterion A5: Experiencing Mathematics

Part B – Student Higher Level Learning

Criterion B1: Opportunities for inquiry, exploration, and generalization in courses
Criterion B2: Student metacognitive development
Criterion B3: Student metacognitive knowledge
Criterion B4: Student higher-order cognitive processes

Part C – Learning Activities Beyond the Classroom

Criterion C1: Instructor disposition and availability
Criterion C2: Availability of supplemental assistance for student success
Criterion C3: Student participation in supplemental assistance opportunities
Criterion C4: Student opportunities for activities outside of the classroom
Criterion C5: Student participation in activities outside of the classroom

Rubric III – Curriculum and Program Development (14 criteria)

Summary

This rubric assesses the extent to which mathematics departments develop, implement, evaluate, assess, and revise courses, course sequences, and programs to help students attain a higher level of quantitative literacy, better quantitative reasoning skills, and achieve their academic and career goals. Mathematics departments, in collaboration with appropriate stakeholders, should regularly engage in course and program review and evaluation to assure that the mathematics curricula 1) prepare students to be numerate citizens and productive employees who have an appreciation for mathematics and lifelong learning and 2) meet the mathematical needs of client disciplines. These course and program reviews and the subsequent revisions should reflect the department's own analysis of student achievement and the informed practice of the mathematics community. Categories include: A) Standards for Content and B) Standards for Intellectual Development.

Part A – Standards for Content

The Standards for Content presented in *Crossroads in Mathematics* provide guidelines for the selection of core concepts that will be taught throughout the first two years of college mathematics. The mathematics needed in the workplace and to be a good citizen has evolved since the publication of *Crossroads in Mathematics* in 1995. The italicized portions of each description were added to address these changes. For specific expectations regarding the seven Standards for Content please refer to Chapters 2 and 3 in *Crossroads in Mathematics.*

Criterion A1: Integration of number sense into the curriculum

Criterion A2: Integration of symbolism and algebra into the curriculum

Criterion A3: Integration of geometry into the curriculum

Criterion A4: Integration of functions into the curriculum

Criterion A5: Integration of discrete mathematics into the curriculum

Criterion A6: Integration of probability and statistics into the curriculum

Criterion A7: Integration of deductive proof into the curriculum

Part B – Standards for Intellectual Development

The Standards for Intellectual Development presented in the Crossroads in Mathematics address desired modes of student thinking and represent goals for student outcomes referred to as competencies. Sentences and phrases in italics show changes based on new knowledge since Crossroads in Mathematics was published in 1995. More detail can be found in Chapter 2 of the document.

Criterion B1: Inclusion of problem solving throughout the curriculum

Criterion B2: Inclusion of modeling throughout the curriculum

Criterion B3: Inclusion of reasoning throughout the curriculum

Criterion B4: Connecting with other disciplines is expected throughout the curriculum

Criterion B5: Communicating is expected throughout the curriculum

Criterion B6: Using technology is expected throughout the curriculum

Criterion B7: Developing mathematical power is expected throughout the curriculum

Rubric IV - Assessment of Student Learning (16 criteria)

Summary

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 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 and the informed practice of the mathematics community. Categories include: A) Course Level Assessment and B) Program Level Assessment.

Part A – Course Level Assessment

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

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

Criterion A3: Linkage of summative assessments to learning outcomes

Criterion A4: Inclusion of formative assessments

Criterion A5: Use of instructor independent assessments where available and appropriate

Criterion A6: Evaluation of the types of student-centered learning activities used in courses

Criterion A7: Evaluation of time devoted to student-centered activities in courses

Criterion A8: Use of data on student preparation and interests in course revision

Part B - Program Level Assessment

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

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

Criterion B3: Collection and analysis of data on program effectiveness

Criterion B4: Use of data on program effectiveness

Criterion B5: Measurement of retention for different student populations

Criterion B6: Use of retention data to improve student persistence

Criterion B7: Assessment of learning in different student populations

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

Rubric V – Diversity, Equity, and Inclusion (13 criteria)

Summary

The purpose of this rubric is to assist departments in thinking through the issues of diversity, equity, and inclusion. Given the history of our nation, the scientific community needs to address the issues of diversity, equity, and inclusion for all groups.

This rubric is adapted from the PULSE rubric which was focused on PEERs- Persons Excluded due to Ethnicity or Race (Asai 2020) and the role of the department in promoting antiracism in its interactions with students, faculty and other department/college constituencies. To broaden the scope, the TfP rubric has been altered to include all Under-Represented Groups (URGs).

The DEI rubric is visionary, and for some of the rubric items, departments may find it difficult to achieve exemplar status without institutional support and reform; there are others that can be implemented relatively easily if a department is motivated to do so. Similar to the other six Teaching for PROWESS Rubrics, this rubric is intended to begin dialogue within a department, have a department begin to think about what inclusive excellence looks like in their department, and help determine the department's future work in building a learning environment that intentionally reflects non-biased principles. Since some of the ideas and terminology might be new to the faculty members within a department, some basic definitions and resources for faculty to review prior to starting to score your department using this rubric include: Core Concepts of Racial Equity, 11 Terms You Should Know to Better Understand Structural Racism, Racial Equity Resource Guide, Key Equity Terms and Concepts, , Mental Health Conditions, *Sexual Orientation and Gender Identity*, *Intellectual Disabilities*, *and Intersectionality*.

Addressing diversity, equity, and inclusion is a difficult and emotionally-charged process. For URGs, it can sometimes be traumatic to constantly be reminded of one's "other" status within a small departmental group. This process can be alienating, demoralizing, and lonely for those experiencing the relentless small and large indignities of exclusion. For non-URG individuals, reading these items may inspire a reaction that may include anger or guilt. We remind non-URG individuals that being pushed out of one's comfort zone can be uncomfortable, even as it is necessary for DEI progress. Having strong feelings, no matter one's identity, is expected and natural during this process. We invite our colleagues to approach this work with humility and openness. Department leadership may be concerned about the reaction of their instructors and staff, as well as how their department will score on the various rubric items. However, the process of completing the DEI rubric will, in many instances, represent a department's first action to become more inclusive and create learning environments that embrace equity. Your department's effort in completing the rubric is an important and commendable first step in reflecting on diversity, equity, and inclusion. Your score represents a starting point and provides you with information to decide where to focus your work on DEI. By implementing specific DEI initiatives in your department, your scores will change. Any increase in DEI rubric scores should be celebrated, as it represents a commitment to improving the climate for URGs.

Each criterion begins with a **CONTEXT** section that should be read *prior to* reading the criterion's descriptors. A consistent range for percentages in the descriptors of the criteria is an attempt to help departments quantify their status. These percentages do not reflect the tipping point for social change cited in Andreoni et al. (2021).

Categories include: A) Curriculum, B) Assessment, C) Faculty Practice/Faculty Support, and D) Climate for Change.

Part A – Curriculum

- Criterion A1: The curriculum includes high impact practices and other inclusive pedagogies
- Criterion A2: Course materials are intentionally made available to all student
- Criterion A3: Diverse perspectives are represented in the curriculum

Part B – Assessment

- Criterion B1: Student success metrics are disaggregated to allow the department to find and address success gaps between various groups in mathematics courses
- Criterion B2: Perceptions of equity and inclusion (climate data) are assessed annually

Part C – Faculty Practice/Faculty Support

- Criterion C1: Faculty awareness of the terminology and knowledge of history of systemic institutional discrimination in higher education
- Criterion C2: Faculty engage in professional development opportunities on such topics as diversity, equity, inclusion, and culturally responsive teaching
- Criterion C3: Faculty are given opportunities to engage in various types of work that promote diversity, equity, and inclusion (DEI) and serve as leaders at the college in this area
- Criterion C4: The department has opportunities for faculty to develop mentoring skills that are inclusive of URG students

Part D – Climate for Change

- Criterion D1: To reduce bias, academic policies are reviewed and modified through the lens of diversity, equity, and inclusion for URGs
- Criterion D2: The department utilizes a holistic approach to recruit, retain, and advance URG faculty during their career
- Criterion D3: The department strives to ensure all department members are treated equitably with particular attention to the intersectionality of marginalized identities with URG identities

Rubric VI – Professionalism (9 criteria)

Summary

This rubric assesses the extent to which institutions hire qualified, diverse mathematics faculty, and support these faculty as they engage in ongoing professional development and service. Institutions should be proactive in recruiting candidates with diverse backgrounds and hiring qualified mathematics faculty. These faculty need to continually expand their mathematics knowledge, stay current with new research on learning and teaching, and be active in the college and the profession. The institution should support mathematics faculty by providing opportunities for faculty to learn and grow in their profession. Categories include: A) Professional Development.

Part A – Professional Development

Rubric VII – Climate for Change (8 criteria)

Summary

The purpose of this rubric is to assist departments in assessing the institutional, administrative, and departmental openness to and movement toward the type of change outlined for mathematics education in the *AMATYC Standards.* Categories include: Attitude Toward Change Initiatives, Strategies for Promoting Change in Teaching Culture, and Concrete Implementations Promoting Change in Teaching Culture. Although many of these criteria are out of the control of departmental 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 or energetic individuals are critical to catalyzing transformation and/or reform. However, there is a critical role for the Board of Trustees and senior level administration, including the Provost, Chancellor, President, VPs, and in some cases Deans, 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 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 departmental transformation. Categories include: A) Attitude toward Change Initiatives, B) Strategies for Promoting Systemic Change in Teaching Culture, and C) Concrete Implementations Promoting Change in Teaching Culture.

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Part A – Attitude Toward Change Initiatives

Criterion A1: Administrative support for national change initiatives in higher education

Criterion A2: Administrative support for state and national change initiatives in mathematics education

Criterion A3: Attitude of department faculty toward national change initiatives in higher education

Criterion A4: Attitude of department faculty toward state and national change initiatives in mathematics education

Part B – Strategies for Promoting Systemic Change in Teaching Culture

Criterion B1: Strategies to recruit and retain qualified diverse teaching faculty

Criterion B2: Institutional support for faculty to update courses

Part C – Concrete Implementations Promoting Change in Teaching Culture

Criterion C1: Mechanisms for collaborative communication on significant educational challenges

Criterion C2: Institutional assessment of student engagement and learning

Criterion C3: Formal evaluation of faculty with a focus on teaching and learning