Supplemental Material

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THE PULSE VISION & CHANGE RUBRICS Version 1.1

Partnership for Undergraduate Life Sciences Education (PULSE) is a collaborative effort developed and funded by NSF, NIH/NIGMS, and HHMI to catalyze adoption of the principles outlined in the 2011 report *Vision and Change in Undergraduate Life Science Education: A Call to Action.* The PULSE Steering Committee selected 40 current and former life science department chairs or deans to serve as Vision & Change Leadership Fellows from September 2012-September 2013. One working group of Fellows, referred to as "Taking the PULSE", developed the PULSE Vision & Change Rubrics during the fellowship year.

The PULSE Vision & Change Rubrics articulate fundamental criteria for evaluating the level of adoption of the principles of *Vision and Change* in life science departments. The rubric descriptors designate different levels of adoption of *Vision & Change* principles from first steps to full departmental transformation. The rubrics initially can provide a structure for departmental reflection and self-assessment and discussion regarding a host of topics relevant to program transformation. The utility of the PULSE Vision & Change Rubrics is to provide a basic framework of expectations, such that evidence of adoption of *Vision & Change* principles can be gathered and self-assessed by departments and a roadmap for continued transformation can be plotted. Ultimately, the rubrics are intended to serve as the basis for a tiered certification program for undergraduate life science departments that have adopted some or all of the principles outlined in the *Vision & Change* report and a blueprint for change in departments that have not yet adopted those principles. These rubrics are designed for flexible use by undergraduate life science departments at a broad range of institution types including two-year colleges, four-year liberal arts institutions, regional comprehensive institutions and research institutions. The core expectations articulated in the PULSE Vision & Change Rubrics can and should be translated into the language of individual departments and institutions, in order to evaluate and expedite departmental transformation in the context of each institution. An institution of any type should be able to achieve each level of certification.

We also anticipate that the rubrics could be used in STEM departments of all types with some modifications, particularly to concepts and competencies specific for life sciences. However, most of the rubric criteria are robust and could apply broadly to the range of STEM disciplines.

SCOPE OF THE RUBRICS

Multi-component rubrics have been developed that can assess department or program alignment with *Vision & Change* recommendations in five areas: Curriculum Alignment, Assessment, Faculty Practice/Faculty Support, Infrastructure, and Climate for Change. Each rubric has several categories with multiple criteria to be assessed. Although many of the scoring criteria are clear, we realize that some criteria may require more explanation, definition of terms, and specific examples to make them comprehensible. At present, we are working on assembling a detailed instruction manual to aid in use of the rubrics. Points are assigned for the levels of achievement in each category. Ultimately each rating criterion will be weighted to reflect the significance of the criterion for program transformation. The weighting will be established through a series of pilot certifications in 2014 (pending funding) and feedback is welcome.

CURRICULUM ALIGNMENT RUBRIC (11 criteria)

This rubric considers the degree to which the curriculum in a Life Sciences program addresses the core concepts for biological literacy and core competencies and disciplinary practice outlined in *Vision & Change*. This rubric has rating criteria for each core concept and core competency providing programs the opportunity to evaluate the integration of these ideas and skills into their curriculum. Most of these criteria are specific to Life Science education and *Vision & Change*, although many of the competencies would be applicable to other STEM fields.

ASSESSMENT RUBRIC (12 criteria)

This rubric addresses the degree to which programs have developed and employ curricular and course learning goals/objectives for students, and have developed and use assessments that are aligned with learning outcomes desired for students at both the course and whole curriculum level. There are two major rating categories, Course-Level Assessment and Program-Level Assessment. Only one criterion is specific to Life Science education and *Vision & Change*; all other criteria would be relevant to any STEM discipline.

FACULTY PRACTICE/FACULTY SUPPORT RUBRIC (21 criteria)

This rubric considers *Vision & Change* implementation issues that primarily are driven by or affect faculty. Overall, there are three main categories including Student Higher Level Learning, Learning Activities Beyond the Classroom, and Faculty Development with 5-10 rating criteria in each category. The Student Higher Level Learning category evaluates faculty efforts and student willingness to reflect on and engage in activities and processes that require higher level cognitive efforts. The category on Learning Activities Beyond the Classroom evaluates the range of opportunities and support mechanisms available to students. The Faculty Development category evaluates the support for faculty within the department and institution that enables them to learn and practice the recommendations of *Vision & Change* and scientific teaching principles. The term "faculty" in this rubric can and should include all applicable appointments including graduate teaching assistants, post-doctoral fellows, adjunct faculty and full time faculty. Also included in this category is recognition of the importance of effective teaching in yearly review, promotion and tenure decisions. The criteria included in this rubric would be broadly applicable to other STEM disciplines.

INFRASTRUCTURE RUBRIC (12 criteria)

This rubric deals with institutional infrastructure issues that facilitate *Vision & Change* implementation. There are three main categories in this rubric: Physical Infrastructure, Learning Spaces, and Resources and Support. The criteria in the Physical Infrastructure category assess the quality of the physical teaching spaces, and the degree to which they enable innovative teaching practices consistent with *Vision & Change*. Criteria in the Learning Spaces category assess whether informal learning spaces and Learning Center spaces are available on campus. The criteria in the Resources and Support category assess various types of staff support for teaching, including administrative assistants, laboratory instructors, and IT specialists. The accessibility of electronic resources is also considered under Resources and Support. The criteria included in this rubric would be broadly applicable to other STEM disciplines.

CLIMATE FOR CHANGE RUBRIC (11 criteria)

This rubric assesses the institution, administrative and department openness to and movement toward the type of change outlined for life sciences education in *Vision & Change*. Categories examine Administrative and Institutional Vision, Attitude and Action, as well as Departmental Support for administrative change efforts. There are 2-3 rating criteria in each category and while many of these criteria are out of the control of departmental faculty, they are critical for transformation and sustainability of reformed efforts in life sciences education.

To download the rubrics and for questions or feedback on the rubrics or the developing certification program, please contact the Taking the PULSE working group at http://www.pulsecommunity.org or the individuals listed below:

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CURRICULUM ALIGNMENT

	Factors	Weight	0 (not observed)	1 (initial stages)	2 (average)	3 (very good)	4 (excellent, exemplar)	Final Score
A. CORE CONCEPTS								0
1	**Evolution core concept integrated into curriculum**		Concept not included in any courses	Students are only minimally exposed to this concept	Students are exposed to this concept in significant detail in at least one required course	Students are exposed to this concept in significant detail in at least one course and implicit understanding is expected in additional courses	Students get multiple opportunities to explore this concept in order to complete their degree	
2	**Structure and function core concept integrated into curriculum**		Concept not included in any courses	Students are only minimally exposed to this concept	Students are exposed to this concept in significant detail in at least one required course	Students are exposed to this concept in significant detail in at least one course and implicit understanding is expected in additional courses	Students get multiple opportunities to explore this concept in order to complete their degree	
3	**Information flow, exchange and storage core concepts integrated into curriculum**		Concept not included in any courses	Students are only minimally exposed to this concept	Students are exposed to this concept in significant detail in at least one required course	Students are exposed to this concept in significant detail in at least one course and implicit understanding is expected in additional courses	Students get multiple opportunities to explore this concept in order to complete their degree	
4	**Pathways and transformations of energy and matter core concept integrated into curriculum**		Concept not included in any courses	Students are only minimally exposed to this concept	Students are exposed to this concept in significant detail in at least one required course	Students are exposed to this concept in significant detail in at least one course and implicit understanding is expected in additional courses	Students get multiple opportunities to explore this concept in order to complete their degree	
5	**Systems core concept integrated into curriculum**		Concept not included in any courses	Students are only minimally exposed to this concept	Students are exposed to this concept in significant detail in at least one required course	Students are exposed to this concept in significant detail in at least one course and implicit understanding is expected in additional courses	Students get multiple opportunities to explore this concept in order to complete their degree	

CURRICULUM ALIGNMENT

	Factors	Weight	0 (not observed)	1 (initial stages)	2 (average)	3 (very good)	4 (excellent, exemplar)	Final Score
B. INTEGRATION OF CORE COMPETENCIES								
1	**Integration of the process of science into the curriculum**		Competency is not included in any courses	Students are only minimally exposed to this competency	Students are exposed to this competency in significant detail in at least one required course	Students are exposed to this competency in significant detail in at least one course and implicit understanding is expected in additional courses	Students get multiple opportunities to explore this competency in order to complete their degree	
2	**Integration of quantitative reasoning into the curriculum**		Competency is not included in any courses	Students are only minimally exposed to this competency	Students are exposed to this competency in significant detail in at least one required course	Students are exposed to this competency in significant detail in at least one course and implicit understanding is expected in additional courses	Students get multiple opportunities to explore this competency in order to complete their degree	
3	**Integration of modeling and simulation into the curriculum**		Competency is not included in any courses	Students are only minimally exposed to this competency	Students are exposed to this competency in significant detail in at least one required course	Students are exposed to this competency in significant detail in at least one course and implicit understanding is expected in additional courses	Students get multiple opportunities to explore this competency in order to complete their degree	
4	**Integration of the interdisciplinary nature of science into the curriculum**		Competency is not included in any courses	Students are only minimally exposed to this competency	Students are exposed to this competency in significant detail in at least one required course	Students are exposed to this competency in significant detail in at least one course and implicit understanding is expected in additional courses	Students get multiple opportunities to explore this competency in order to complete their degree	
5	**Communication and collaboration through a variety of formal and informal written, visual, and oral methods integrated into curriculum**		Competency is not included in any courses	Students are only minimally exposed to this competency	Students are exposed to this competency in significant detail in at least one required course	Students are exposed to this competency in significant detail in at least one course and implicit understanding is expected in additional courses	Students get multiple opportunities to explore this competency in order to complete their degree	
6	**An understanding of the relationship between science and society is embedded into the curriculum**		Competency is not included in any courses	Students are only minimally exposed to this competency	Students are exposed to this competency in significant detail in at least one required course	Students are exposed to this competency in significant detail in at least one course and implicit understanding is expected in additional courses	Students get multiple opportunities to explore this competency in order to complete their degree	

ASSESSMENT

	Factors	Weight	0 (not observed)	1 (initial stages)	2 (average)	3 (very good)	4 (excellent, exemplar)	Final Score
A. COURSE LEVEL ASSESSMENT								0
1	**Learning outcomes are well written and clearly related to core concepts and competencies**		Learning outcomes are not related to core concepts and competencies	Learning outcomes are not clearly related to concepts and competencies	Learning outcomes are somewhat related to concepts and competencies	Learning outcomes are well written and are mostly related to concepts and competencies	Learning outcomes are well written and clearly related to concepts and competencies	
2	**Learning outcomes are explicitly presented in the courses**		Learning outcomes are not explicitly presented	Learning outcomes are explicitly presented in the syllabus but not discussed with students during the course	Learning outcomes are explicitly presented in syllabus along with an explanation of how outcomes will be measured during course	As in level 2; in addition outcomes and their measurements are discussed with students	As in level 3; in addition outcomes and their measurements are discussed with students numerous times during the course	
3	**Assessments linked to learning outcomes**		Assessments are not linked to learning outcomes	Some courses have assessments that measure learning outcomes	Many courses have assessments that measure learning outcomes	The majority of courses have assessments that measure learning outcomes	The majority of courses have assessments that clearly measure learning outcomes	
4	**Instructor-independent assessment tools are utilized**		No assessment tools are instructor independent	Less than 25% of assessment tools used are instructor independent but are generated within the department	At least 25% of assessment tools used are instructor independent but are generated within the department	At least 50% of assessment tools used are instructor independent and include some that are generated external to the department	At least 75% of assessment tools used are instructor independent with many generated external to the department	
5	**Course quality evaluation includes assessing time in student-centered activities**		Time spent in student-centered activities is not measured	Time spent in student-centered activities is informally estimated at the end of semester/quarter	Time spent in student-centered activities is documented by approximation after the fact in formal course quality evaluation at the end of semester/quarter	Time spent in student-centered activities is informally tracked at periodic points throughout the semester/quarter and reported in formal course quality evaluations at end of semester/quarter	Time spent in student-centered activities is formally documented at periodic points throughout the semester/quarter and reported in formal course quality evaluation at end of semester/quarter	
6	**Use assessment pre- and post-instruction to measure effectiveness of instructional approaches**		No assessment	Less than 25% of courses include pre- or post-instruction assessments	25-50% of courses include pre- or post-instruction assessments	51-75% of courses include pre- and post-instruction assessments	More than 75% of courses include pre- and post- instruction assessments	
7	**Evidence of student preparedness and interests are used to inform curricular changes that reflect student preparedness and interest**		No evidence is collected or used to inform curricular change	Less than 50% of instructors report occasionally using anecdotal reports	Instructors are encouraged to conduct regular surveys and/or assessments, at least 50% of instructors survey/assess their students but results are not used when planning curricular changes	All characteristics listed for a score of 2 are present but results are consulted in planning curricular changes and real world examples are aligned with student preparedness and interest; progress is reported annually	All characteristics listed for a score of 3 are present, at least 75% of instructors survey/assess their students, instructors track and report progress annually which is rewarded during annual performance review	

ASSESSMENT

	Factors	Weight	0 (not observed)	1 (initial stages)	2 (average)	3 (very good)	4 (excellent, exemplar)	Final Score
B. PROGRAM LEVEL ASSESSMENT								
1	**Assessment of six V&C competencies at the program level**		Competencies not assessed at the program level	Development of at least one of the competencies assessed	Development of 2-3 competencies assessed	Development of 4-5 competencies assessed	Development of all 6 V&C competencies assessed	
2	**Direct and indirect data on program effectiveness are collected and analyzed; the results are used to strengthen programs**		Overall program effectiveness is not assessed	Data collected but results are not used for improving the program	Data collected, results are used to try to improve the program but resulting change is not tracked	Data collected with clear purpose, and continual dialog regarding the results is used to guide efforts to improve the program but resulting change is not tracked	Data collected with clear purpose, and continual dialog regarding the results is used to guide efforts to improve the program, resulting changes are identifiable and measured	
3	**Assess retention of all kinds of students in the program**		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 as for 2 but also includes students at critical transition points	Data collected as for 3; data are critically analyzed	
4	**Retention assessment data are used for improving student retention**		Data are not used	Data are collected but are not used in any clear way	Data are used in a coordinated capacity to improve retention	Data are used in a coordinated and consistent way across the areas of the program to improve retention	Data are used in a coordinated and consistent way with strategies implemented and assessed for levels of success	
5	**Use assessments as tools to identify whether there are differences in learning outcomes and the nature of these differences among different student populations (e.g. women and under-represented minority students)**		No effort made to identify differences	Assessments provide suggestions of differences, but no efforts are made to use the information to develop strategies to address achievement gaps	Assessments provide suggestions of differences, information discussed and used informally to address achievement gaps	Assessments provide suggestions of differences, formal interventions developed to address achievement gaps	Assessments provide suggestions of differences; interventions developed to address achievement gaps; achievement gaps between various segments of student body measured to assess the impact of interventions on	

FACULTY PRACTICE/FACULTY SUPPORT

	Factors	Weight	0 (not observed)	1 (initial stages)	2 (average)	3 (very good)	4 (excellent, exemplary)	Final Score
A. STUDENT HIGHER LEVEL LEARNING								0
1	**Exposure to inquiry-based, open-ended research and interpretation in course labs: guided inquiry or research that requires hypothesis generation/data interpretation**		All laboratory experiments have known outcomes ("cookbook labs")	Exposure is limited; <50% of students are not exposed	Inquiry modules are used a large fraction of lab courses; more than 70% of students are exposed	Inquiry modules are included in the majority of course labs. Every student has at least one exposure; Some students have several exposures	Inquiry is the norm in most labs. Students are accustomed to formulating questions and interpreting findings	
2	**Exposure to inquiry, ambiguity, analysis and interpretation in non-lab courses**		Most courses do not provide such opportunities; student have little exposure	25% or less of courses have such opportunities; a subset of students are exposed	Class sessions/ assignments in ~25-50% of courses have multiple opportunites; many student are exposed	Greater than 50% of courses have opportunities, most students are exposed	Such opportunities are the norm in courses; all student are exposed, many get multiple exposures	
3	**Instructors encourage/teach student metacognition: instructors guide students to reflect on their learning styles and understand how to use learning strategies that are supported by cognitive research**		Instructors do not encourage student metacognition	<25% of Instructors discuss and encorage effective learning strategies	25-50% of instructors discuss and encourage effective learning strategies	Students in >50% of courses are encouraged to reflect, and some instructors integrate practice of effective strategies within assignments	Instructors routinely intentionally integrate practice of effective strategies within assignments	
4	**Students' Metacognitive Knowledge: students reflect on their learning styles and understand and use learning strategies that are supported by cognitive research**		Students are unreflective and lack awareness or understanding	Students rarely reflect on styles and have only minimal knowedge	Most students have some awareness, but many lack the knowledge to effectively use	Most students have some awareness; many have the knowledge to employ	Students are adept at using strategies to improve learning outcomes for self and peers.	
5	**Students Practice Higher-Order Cognitive Processes**		Students use only lowest-level cognitive processes (memorization/ recall) across the curriculum. Instructors are not aware and/or not encouraged to reflect on cognitive level of tasks	Students' cognitive processes remain at lower levels but may include understanding and application in addition to recall. Typically there is no organized effort among instructors to distinguish cognitive level of tasks	A small proportion of students (<25%) in specialized, upper-level courses are challenged to use higher-order cognitive processes (e.g., synthesize, evaluate, create). A few instructors may be leading efforts to move students to higher-order cognition	Higher-order cognitive processes are practiced by students at all course levels, but such practice is not yet ubiquitous across all courses, and not all instructors are adept at developing tasks for student practice at these higher levels	Students regularly work at higher cognitive levels in most courses, and instructors are adept at developing assignments and exams for practice at each level	

FACULTY PRACTICE/FACULTY SUPPORT

Factors	Weight	0 (not observed)	1 (initial stages)	2 (average)	3 (very good)	4 (excellent, exemplary)	Final Score
B. LEARNING ACTIVITIES BEYOND THE CLASSROOM							
1	**Availability of intramural and/or Extramural Mentored Research: Student opportunities**	No opportunities exist	Limited opportunities available; <25% of students can be accommodated	26-50% of students can be accommodated	51-75% of students can be accommodated	>75% of students can be accommodated	
2	**Availability of intramural and/or Extramural Mentored Research: Student exposure, % of students who graduate with one or more summer/semester of mentored research**	No students participate in mentored research.	<15% students participate	16-30% students participate	31-60% students participate	>60% students participate	
3	**Advisors and formal programs encourage and support student participation in research by proactively helping students find opportunites and understand the value through activites that schowcase student research**	No support mechanisms	Minimal informal support	Proactive informal support	Formal program and some informal mechanisms	Extensive programming and other mechanisms promote and support	
4	**Instructors available and welcoming beyond classroom/lab hours; instructors interested in student success**	Instructors not available	Instructors available, but >50% are perceived as distant, unresponsive	>50% of the instructors are perceived as available and welcoming	>75% of instructors perceived as available, welcoming, supportive	All instructors perceived as available, approachable, helpful, and supportive	
5	**Opportunities for supplemental student engagement for thriving in STEM are provided, such as tutoring, peer mentoring, advising, interest-based clubs, internships, etc**	Supplemental engagement methods are absent	Supplemental engagement opportunities are minimal (e.g., one or two methods; few students offered opportunities)	Supplemental engagement methods are diverse, but only offered to a small subset of students	Supplemental enagement methods are diverse and widely available	All of level three criteria are met; Supplemental engagement methods are promoted by course instructors	
6	**Student participation in supplemental student engagement opportunities**	Supplemental engagement opportunties utilized by <10% students	Supplemental engagement opportunties utilized by less than 25% of students	Supplemental engagement opportunties utilized by 26- 50% of students	Supplemental engagement opportunties utilized by 51-75% of students	Supplemental engagement opportunties utilized by >75% of students	

FACULTY PRACTICE/FACULTY SUPPORT

Factors	Weight	0 (not observed)	1 (initial stages)	2 (average)	3 (very good)	4 (excellent, exemplary)	Final Score
C. FACULTY DEVELOPMENT							
1 **Awareness of National Efforts in Undergraduate STEM Education Reform**		Instructors isolated from the national dialogue	Pockets of awareness of need for reform and national efforts exist	50% of the faculty aware of reform and national efforts	75% of the faculty aware of reform and national efforts	Awareness of the need for reform and national efforts is widespread	
2 **Faculty Attendance at meetings and workshops related to Life Science education reform**		Faculty do not attend conferences or workshops related to reform	Small fraction of instructors (<10%) have opportunity or desire to attend national meetings. Usually pay own expenses to such meetings	Cadre of instructors (25%) attend national meetings and workshops; limited financial support available	A large number (50%) of instructors attend national conferences and/or on-campus workshops, typically with financial support	>75% of instructors regularly participate in workshops and dialogue on STEM reform. Instutional support exists for attendance at conferences, etc	
3 **Awareness/ Implementation of Discipline-based Education Research (DBER)**		Faculty are unaware of DBER and its utility	A small subset of faculty is aware of DBER findings and use this information to inform class practice	At least 25% of the instructors are aware of and use DBER findings	At least 50% of the instructors are aware of and use DBER findings	At least 75% instructors are aware of and use DBER findings	
4 **Sharing of information about evidence-based and effective pedagogy**		No sharing of pedagogical methods, data about effective teaching practices with colleagues	There is little sharing of ideas data and techniques with colleagues	At least 25% of instructors regularly share ideas and techniques	At least 50% of instructors regularly share ideas and techniques	At least 75% of instructors regularly share ideas and techniques. Some formalized discussion groups exist	
5 **Pedagogical Approaches Reflect Best Practices**		Lecturing without student engagement is dominant practice in all life science courses.	Traditional lectures interspersed with student responses to prompts (e.g., < 25% of time students are engaged). More engaging pedagogies used by one or few instructors	A core group of practitioners is shifting department's attitudes and practices toward more widespread use of engaging pedagogies	All instructors are learning about and attempting to adopt best pedagogical practices, although reverting to lecturing for more than 25% of classtime is common	Students rarely sit passively listening to lectures. Students are engaged in discussion, guided inquiry, and other activities in class and lab	

FACULTY PRACTICE/FACULTY SUPPORT

	Factors	Weight	0 (not observed)	1 (initial stages)	2 (average)	3 (very good)	4 (excellent, exemplary)	Final Score
C. FACULTY DEVELOPMENT								
6	**Instructors Pursue Shared Learning Goals**		Learning goals (concepts, competencies, & dispositions) are unknown/not articulated.	Learning goals are vague or are professed in static documents, but they are not pursued with intentionality nor are they apparent to students	Learning goals are written (e.g., department web page), but goals are not readily apparent to students nor consistantly pursued by all instructors	Learning goals are clearly documented (e.g., course syllabi) and discussed with students. However, not all instructors have mastered matching assignments and student practices to achieve goals	Learning goals are clear and intentionally pursued in courses across curriculum, courses are constructed to achieve goals, assignments give practice in learning outcomes, all syllabi reflect goals	
7	**Support for Teaching/Learning Needs in STEM**		No formal support, such as Teaching and Learning Center (T&L Center)	T&L Center or other formal support available but programming limited and awareness of STEM education needs also limited	T&L Center or other formal programming is broad in scope but does not address particular needs of STEM faculty	T & L Center or similar structure supports STEM faculty with customized workshops for STEM teaching and learning	T&L Center or similar structure offers responsive programming that includes workshops and consultation to meet the needs of STEM faculty; Center reaches out to STEM faculty	
8	**Faculty orientation and mentoring for teaching role**		Instructors receive no formal orientation to institutonal or departmental policies and practices. Mentoring of any type is informal if present	Mandatory, single-session orientation for new facutly/staff to institution includes little or no orientation to development of scientific teaching. If present, mentoring for teaching is informal and rarely includes adjunct instructors	Orientation includes additional informal gatherings around development of teaching skills for first-year instructors (optional for adunct instructors). Formal mentoring occasionally includes pedagogy	Multiple, formal orientation sessions around teaching are mandatory for new faculty/staff, including adjuncts, throughout the first year. Designated formal mentor is well-versed in pedagogy	All of conditions to achieve a score of 3 exist; in addition, on-going institutional/ departmental discussions around teaching encourage continuing effort to learn throughout the pre-tenure period	
9	**Institutional support for faculty course development**		Course development/ renovation is not recognized as an important activity;such work is discouraged; no impact on load	Course development/ renovation is not recognized as an important activity, but not actively discouraged; no impact on load	Course development/ renovation is recognized as an important activity; no impact on load	Course development/ renovation is recognized as an important activity; reduced load is granted	All the conditions to achieve 3 are present; faculty are ecouraged to experiment and given flexibility to design pilots	
10	**Institutional support for faculty training in emerging areas**		Faculty are discouraged from taking time for such training	Faculty who participate in such training do so without financial support	Faculty who participate in such training can request support; occasionally granted	Faculty who participate in such training can request support; frequently granted	The department/ institution has funds designated for such activities and faculty are encouraged to use it	

INFRASTRUCTURE

	Factors	Weight	0 (not observed)	1 (initial stages)	2 (average)	3 (very good)	4 (excellent, exemplary)	Final Score
A. PHYSICAL INFRASTRUCTURE								0
1	**Classrooms and teaching laboratories can accommodate special needs and differing abilities**		None of the classrooms serve students with diverse needs.	<10% of assigned classrooms comply, very limited ability to serve students with diverse needs	10-25% of assigned classrooms comply	26-75% of assigned classrooms comply	>75% of assigned classrooms comply	
2	**Access to flexible, re-configurable teaching spaces to encourage student interaction, ability to work in small groups**		All assigned classrooms are lecture style with fixed seating	< 10% of assigned classrooms are flexible and reconfigurable	10-50% of assigned classrooms are flexible and reconfigurable	50-75% of classrooms are flexible and reconfigurable; different types of classrooms are available for diverse teaching styles	>75% of classrooms are flexible and reconfigurable; different types of classrooms are available for diverse teaching styles	
3	**Classroom IT infrastructure to encourages active-learning practices**		All assigned classrooms have no IT technology	< 10% of assigned classrooms have at least one IT resources for active learning purposes	10-50% of assigned classrooms have at least one resource for active learning purposes	10-50% of assigned classrooms have at least two IT resources for active learning purposes	More than 50% of assigned classrooms have at least two IT resources for active learning purposes	
4	**Access to intelligently-designed laboratory space flexible enough to allow different uses that blur distinction between lecture and lab**		Laboratories are antiquated (possibly dangerous); prep and equipment space is not separated	<10% of laboratories are well designed with prep and equipment space separated	10 - 50% of laboratories are well designed with prep and equipment space separated; IT resources available	51 - 75% of laboratories are well designed with prep and equipment space separated; IT resources available	76% - 100% of all laboratories are well designed with prep and equipment space separated; IT resources available	
5	**Equipment/supplies in teaching laboratories**		Limited laboratory equipment available to students, >90% of equipment is old or antiquated, supplies for laboratories are very limiting	>25% of equipment is new, equipment is available for student use but not enough equipment for the student load, supplies for laboratories are limiting	>50% of equipment is new, equipment is comes close to meeting the student load, supplies for laboratories are adequate	51 - 75% of equipment is new, amount ouf available equipment matches the student load, supplies for laboratories are adequate	>75% of equipment is new, amount ouf available equipment matches the student load, supplies for laboratories are adequate	

INFRASTRUCTURE

	Factors	Weight	0 (not observed)	1 (initial stages)	2 (average)	3 (very good)	4 (excellent, exemplary)	Final Score
B. LEARNING SPACES								
1	**Informal gathering spaces that encourage collaboration**		Informal gathering space not available	A space is available but not located near labs, classrooms, or faculty offices - use is not encouraged	A space is available but not located near labs, classrooms, or faculty offices; use is encouraged by administation	Several good spaces are available; at least one is near labs, classrooms, or faculty offices; use is encouraged by administation	Several good spaces are available; all are near labs, classrooms, or faculty offices; use is encouraged by administation	
2	**Learning Center for Students - for example, college-wide writing centers, learning centers or dept. level center with staff, tutor meeting rooms, TAs, computers and printers, study space for students**		None	Facility available; no staff; limited range of options; limited hours	Staffed facility available; limited range of options; limited hours	Facility available; multiple staff members (overseer, tutors), addressing multiple student needs (writing, math, bio); extended hours; multiple breakout rooms available	All characteristics listed for a score of 3 are present; also staffed with learning specialist; open most of the time to meet students needs	
C. RESOURCES AND SUPPORT								
1	**IT support for innovative teaching, responds quickly to IT crisis; support includes hands-on technology training for faculty and proactive survey of new technology**		No IT support	IT staff provides limited support; faculty are not satisfied with level of support when issues arise	IT staff provide support adequate to meet faculty needs when issues or problems arise	All characteristics listed for a score of 2 are present, in addition IT staff provide hands-on training	All characteristics listed for a score of 3 are present; proactive IT staff also suggest innovative technologies	
2	**Staff support for teaching: administrative help to support teaching, lab managers/lab instructors, curriculum development/learning specialists, tenure-track faculty with education specialty**		No staff support for faculty	Very limited support, e.g. part time administrative support or part-time lab support help	A minimum of the equivalent of one full time position dedicated to teaching support	Adequate administrative and lab managers/instructor support provided. Department has either a curriculum development position or biology education-based tenure-track faculty position	Adequate administrative and lab managers/instructor support provided. Department has both a curriculum development position or biology education-based tenure-track faculty position	
3	**Institutional support for electronic resources, e.g. journal subscriptions and databases**		No institutional subscriptions available	Very limited subscriptions available, only to top journals (e.g. *Nature*, *Science*, *PNAS*)	Subscriptions extend to the top journals in each subfield (e.g *Ecology*, *Journal of Cell Biology*, *Nature Genetics* etc.), but specialty journals offerings are limited	Subscriptions extend to some specialty journals in selected subfields. But it is still common that articles that faculty and students require are not freely available	Wide range of electronic journals, databases are available for use by faculty and students without fee. Rare that a journal article cannot be freely obtained	

CLIMATE FOR CHANGE

	Factors	Weight	0 (not observed)	1 (initial stages)	2 (average)	3 (very good)	4 (excellent, exemplar)	Final Score
A. ADMINISTRATIVE AND INSTITUTIONAL VISION								0
1	**Vision is clear and specific**		Administrative vision has not been written	Administrative vision is written, but uses vague or unclear language; department members do not understand or are not aware of the vision	Administrative vision is written, uses clear language, and department members express basic awareness and/or understanding of the vision	Components of 2 are present and vision has been distributed amongst dept. members and discussed. Feedback on feasibility and innovativeness have been collected from dept. members	Components of 3 are present and feedback has been incorporated into a new vision statement that is clear, innovative, and feasible	
2	**Vision aligns with V&C priorities**		Vision is not aligned with V&C priorities	Vision is aligned with 25% of less of the V&C priorities	Vision is aligned with 25-50% of the V&C priorities	Vision is aligned with 50-75% of V&C priorities	Vision is aligned with 75% or more of V&C priorities	
3	**Commitment to vision is demonstrated through administrative action**		No discussion of the implementation of the vision occurs	Casual discussion occurs about implementing the vision but no action items chosen	Casual discussion of how to implement the vision occurs and action items chosen but not followed through	Formal discussion of how to implement the vision occurs and all important players attend; action items are chosen and followed through but not formally recorded	Components of 3 are present plus formal recording/monitoring system exists for following up with delegated activities	
B. ADMINISTRATIVE AND INSTITUTIONAL ATTITUDE								
1	**Administration is supportive of the need for change**		Admin. expresses resistance to change, such as change items not included on meeting agendas, no funding support for change towards national initiatives, faculty report feelings of hostility from admin. regarding discussion of changing practices; difficulty in attaining meetings with admin. officials to discuss change	Administration does not openly express resistance to change, but avoids discussion of change by not supporting opportunities to discuss change; change items may be included in meeting agendas but not actively discussed/no action items taken	Administration verbally expresses support for change but does not put financial or other resources towards doing so (i.e. requires change to be sought out by individual faculty)	Administration verbally expresses support of change and provides some, but not enough, financial resources towards change and/or only some faculty are able to secure these resources	Administration is verbally and financially supportive of change initiatives across the entire department	
2	**There is awareness and buy-in of national initiatives in higher education**		Administration does not recognize/is not aware of national initiatives	Administration is aware of national initiatives, but no action is taken	Administration is aware of national initiatives and takes observable action to promote initiatives on occasion, but no long-term plan or funding is in place	Administration is aware of national initiatives and takes observable action to promote initiatives on a regular basis and/or short-term action plan is in place	Components of 3 are present and admin. allocates resources and establishes a long-term action plan	
3	**Institutional evaluation and assessment reflects the importance of teaching**		No institutional evaluation and assessment of learning gains and teaching portfolios	Institutional recognition of the need to evaluate and assess learning gains and teaching portfolios, but nothing formal available for departments	Faculty/departmental levels assessments of learning gains and teaching portfolios conducted but not aggregated at an institutional level	Institutional data includes assessments of learning gains and teaching portfolios conducted at the faculty/departmental level but not consistent in measurement across the institution	Institutional data includes consistent, formal in-depth assessments of learning gains and teaching portfolio aggregated at the institutional level	

CLIMATE FOR CHANGE

	Factors	Weight	0 (not observed)	1 (initial stages)	2 (average)	3 (very good)	4 (excellent, exemplar)	Final Score
C. ADMINISTRATIVE AND INSTITUTIONAL ACTION								
1	**Strategies are in place to recruit and retain diverse teaching faculty**		No active strategy for recruiting diverse teaching faculty either informally or formally	The need to recruit and retain diverse teaching faculty is mentioned informally as important, but no formal action is taken	Formal action is taken to seek diverse candidates, search committee chairs and department chairs are trained on how diversity is supported at the institution	Components of 2 are present and resources are provided to incentivize hiring diverse teaching faculty, candidates are exposed to the diversity on campus when they visit	Components of 3 are present and a process exists to measure success in recruitment and retention of diverse teaching faculty, diverse teaching faculty have achieved success via promotion	
2	**Faculty incentives exist for transformative approahces in teaching**		No incentives exist for faculty to be rewarded for creative teaching and some barriers exist	Informal recognition (i.e. email praise) exists but is rare and infrequent for faculty who teach in creative ways	Informal recognition is common for all faculty who teach in creative ways, formal awards exist that consider or emphasize a faculty's teaching merit; transformative teaching methods are mentioned but not heavily weighted in annual review, promotion and tenure (P&T)	Components of 2 are present and several formal awards exist for recognizing innovative teachers, transformative teaching methods and the scholarship of teaching and learning are actively considered in P&T	Components of 3 are present, transformative teaching methods and scholarship of teaching and learning are actively considered/weighted in P&T and this is widely understood throughout the department	
3	**Resources exist for faculty to improve their teaching methods**		Resources are not available for faculty to improve their teaching methods	Some resources are available for faculty to improve their teaching methods but are widely unknown and unused by faculty	Resources exist for improving teaching methods, and are used by a minority of the faculty; all faculty are aware resources exist	Components of 2 are present and resources are actively distributed, disseminated, or paid for by department leaders to improve faculty's teaching methods	Components of 3 are present and nearly all faculty use these resources and are aware resources exist	
4	**Fundraising and development efforts support departmental transformation in alignment with V&C**		Fundraising efforts are not aligned with V&C	Fundraising efforts aligned with V&C derive only from individual faculty members	There is at least one fundraising effort in support of V&C at the department level	There are fundraising efforts in support of V&C at the department level and a discussion of fundraising at the institutional level	There are successful fundraising efforts in support of V&C at the departmental and institutional levels	
D. DEPARTMENTAL SUPPORT								
1	**There is a collaborative communication process in place, including disseminating new ideas**		There is no department wide communication strategy for sharing new ideas about V&C	There is an informal communication strategy to discuss new ideas about V&C but includes only a small group of participants with infrequent, irregular meetings	There is an informal communication strategy to discuss new ideas about V&C and includes the majority of department members with frequent, but irregular meetings	There is a formal communication strategy including both face to face meetings and email exchanges to discuss new ideas about V&C, all deparment members are invited and some collaboration is discussed	Components of 3 are present and active collaboration around the V&C takes place	
2	**There is faculty support for the administrative vision within the department**		Department faculty are unaware of the administrative vision	Department faculty are aware of the administrative vision but express hesitancy to adopt the vision for the department (avoid discussing at meetings; express worry or negativity; express confusion on how to adopt this vision)	Department faculty are aware of the administrative vision and express verbal willingness/support for the vision, but no formal action is taken	Components of 2 are present and action is taken but no reporting or formal mechanism is developed for implementing the vision long-term	Components of 3 are present and formal reporting is conducted on current actions, and a plan is written on how to achieve the vision over long-term	

The PULSE Vision & Change *Snapshot* Rubric version 2.0

The PULSE Vision & Change Snapshot Rubric is designed as a tool for faculty and administrators to gain a quick overview of the alignment of their life science program with some of the major elements of the recommendations of the *Vision and Change* (V&C) report (2011). The PULSE Vision & Change Snapshot Rubric includes components of the five separate rubrics that make up the complete PULSE Vision & Change rubrics: 1) Curriculum Alignment, 2) Assessment, 3) Faculty Practice/Faculty Support, 4) Infrastructure, and 5) Climate for Change. The complete set of rubrics is designed as a diagnostic tool to be used in a self-study to evaluate the extent of implementation of the recommendations of the Vision and Change (V&C) report (2011) in life science programs and majors. They were developed based on the features expected in a department that had fully implemented all of the V&C recommendations. The rubrics help departments and programs highlight the areas where they stand out and areas where they have made less progress. The complete set of rubrics is part of a Recognition process that acknowledges departments and programs that have made progress in implementation of V&C recommendations. More information is available here: http://www.pulsecommunity.org/page/recognition.

This short Snapshot Rubric is intended to be used for several purposes: a) as an entry point or gateway to the complete set of five rubrics, b) as a brief overview for conference and workshop participants, and c) as a standardized instrument to collect data across the PULSE regional meetings in various geographical locations. Most of the criteria come directly from the complete set of rubrics, but in a few instances multiple full rubric criteria have been collapsed into one for the sake of brevity.

Departments can compare their scores to those of other institutions (of similar or different types) and use the data to develop plans for program changes to better align with national priorities for STEM education.   Data collected using the rubrics are extremely valuable in understanding the landscape of teaching and learning that exists and how that landscape is changing over time. Thus, we are very interested in collecting data from departments who fill out the Snapshot rubric. We have established an online rubric data entry portal. Please consider depositing your department's information in the Snapshot rubric data entry portal (http://www.pulsecommunity.org/page/recognition)

The use of the term 'faculty' throughout the rubric 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 program being evaluated. The use of 'term' is intended to encompass whatever unit is relevant for individual institutions, such as semester or quarter.

The specific instructions in the next section go through each criterion of the Snapshot rubric, providing details to clarify meaning and scoring. They are best used concurrently with the rubric. Links are provided for navigation between the instructions and rubric sections. These links *(go to rubric, go to instructions)* can be found next to each section heading and will take the PDF-user back and forth within this document.

A Partnership between   and 40 PULSE Fellows

Instructions for the PULSE Vision & Change *Snapshot* Rubric v2.0

The core concepts and competencies described in *Vision and Change* reflect the combined thinking of thousands of scientists over the past decade or more. For specific descriptions of the core concepts and core competencies, please refer to Chapter 2 of the 2011 *Vision and Change* report, particularly pages 12-16. Because of this strong consensus among life scientists, we are using the language in the *Vision and Change* 2011 report as the basis for this evaluation.

A. INTEGRATION OF CORE CONCEPTS INTO CURRICULUM *(go to rubric)*

A1 – Integration of core concepts into the curriculum
The five V&C core concepts are evolution; structure and function; information flow, exchange and storage; pathways and transformations of energy and matter; and systems. For details of specific concepts to be covered, refer to the BioCore Guide (Brownell *et al.* 2014) available here http://www.lifescied.org/content/suppl/2014/05/16/13.2.200.DC1/Supplemental_Material_2.pdf.

B. INTEGRATION OF CORE COMPETENCIES INTO CURRICULUM *(go to rubric)*

B2 – Integration of core competencies into the curriculum
This criterion measures the number of competencies that students are exposed to in detail in the process of completing a major/program.

B3 – Extent of core competency integration into the curriculum
This criterion measures whether students have multiple detailed exposures to the competencies in the process of completing a major/program.

The following are brief descriptions of the six core competencies described in the *Vision and Change* report (2011). More detail can be found in Chapter 2 of the report.

Process of science
This competency concerns development of student competency regarding the application of the process of science. Achieving this competency requires providing students with opportunities to practice formulating hypotheses, testing them experimentally or observationally, and analyzing the results.

Quantitative reasoning
This competency concerns development of student competency regarding the use quantitative reasoning. For quantitative reasoning resources visit this URL: http://www.nimbios.org/resources/. For a recent paper on integrating quantitative reasoning into an introductory biology course see: Hester *et al.* CBE—Life Sciences Education Vol. 13, 54–64, Spring 2014.

Modeling and simulation
This competency concerns development of student competency regarding use of modeling and simulation. Because biological systems are complex, changing, and interacting, the opportunity to learn about and practice modeling and simulating those systems can provide students with insight into the important means of clarifying these dynamic interactions. Examples of modeling/simulation software include SimBio (http://simbio.com), STELLA (http://www.iseesystems.com), and NetLogo (http://ccl.northwestern.edu/netlogo/).

Interdisciplinary nature of science

This competency concerns development of student competency to tap into the interdisciplinary nature of science. Sub-disciplines of biology are often reaching to other disciplines to learn techniques and approaches that can shed light on biological phenomena. Achieving this outcome can be supported by a climate that values interdisciplinary thinking and provides opportunities for students to develop some fluency in other disciplines through associated coursework, course activities (e.g. by integrating interdisciplinary case studies), course-based interaction with students and experts in other disciplines or in collaborations outside the classroom setting. Another way to foster interdisciplinary competence is through courses that are co-taught by a life scientist and an instructor from another discipline, e.g. mathematics, computer science, chemistry, anthropology, physics, and engineering.

Communication and collaboration

This competency concerns development of communication skills. It is important for students to learn to communicate effectively in typical written and oral scientific formats, and this communication is necessary for effective collaboration with colleagues within and outside the student's discipline.

Understanding of the relationship between science and society

This competency concerns development of student competency to understand the relationship between science and society. Scientific study and research are conducted within social structures and, consequently, scientists need to understand how those social structures work and how to participate in society such that both science and society benefit. Another aspect is instilling in students the idea that science can be used to help solve major societal problems, for example human disease and environmental degradation. For this connection to be made, students need to understand not only the science, but also the complexity of the social problems that are addressed.

C. COURSE LEVEL ASSESSMENT *(go to rubric)*

[The PULSE website](http://www.pulsecommunity.org/page/assessment) (http://www.pulsecommunity.org/page/assessment) contains links to many assessment tools listed below.

C4 – Linkage of summative assessments to learning outcomes

This criterion requires careful articulation of course-level learning outcomes and intentional selection or development of assessments to measure student achievement of the outcomes. The PULSE community website link provided at the beginning of this section includes a wide variety of assessments that can be used in specific life science courses or could provide ideas for development of local course-specific instruments. 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, it is essential that assessments be valid and carefully mapped to the outcomes (rather than generically appropriate for the course such as a standardized test used across many sections which provides broad information about student knowledge, but is difficult to use for specific course improvements).

C5 – Evaluation of time devoted to student-centered activities in courses

This criterion is focused on time spent in student-centered activities. Ideally, both student and peer-observers should have a chance to evaluate this factor. For student assessment, course evaluations might include questions about specific active learning techniques. A variety of instruments for peer observation to assess this criterion are currently in use, for example, The Classroom Observation Protocol for Undergraduate STEM (COPUS) (http://www.lifescied.org/content/12/4/618.full) and the Reformed Teaching Observation Protocol

(RTOP) (http://serc.carleton.edu/NAGTWorkshops/certop/reformed_teaching.html). 'Term' refers to either semester or quarter, as appropriate for the specific institution.

D.   PROGRAM LEVEL ASSESSMENT *(go to rubric)*

D6 – Assessment of the six V&C competencies at the program level
This criterion seeks to specifically address the integration of the *Vision and Change* core competencies into a major or program. Ideally, this would best be evaluated with some sort of single "exit exam" based on *Vision and Change* core competencies. However, such an instrument does not currently exist. Some standardized tests, for example the Educational Testing Service's Major Field Test in Biology, assess a subset of *Vision and Change* core competencies. A second option is to use some sort of portfolio evaluation during the students' final year in the program. The use of ePortfolios for this purpose is gaining traction. See http://net.educause.edu/ir/library/pdf/eli3001.pdf for an overview or browse the *International Journal of ePortfolio* (http://www.theijep.com).

D7 – Use of data on program effectiveness
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. Direct measures of student learning include comprehensive exam/concept inventory scores for graduating students, portfolios, capstone projects, or oral examinations. Indirect measures include course grades, measures of the number of students that progress to graduate school or employment, and comparison of enrollment numbers. A fairly comprehensive list of direct and indirect measures of student learning can be found at: http://www.csuohio.edu/offices/assessment/exmeasures.html.

E.   PEDAGOGY AND STUDENT HIGHER LEVEL LEARNING *(go to rubric)*

E8 – Opportunities for inquiry, ambiguity, analysis, and interpretation in coursework
This criterion is focused on the degree to which scientific inquiry is incorporated into courses, whether or not the course includes a formal laboratory component. In other words, to what degree do students have the opportunity to do what scientists do, namely design experiments, formulate hypotheses, and evaluate data? One key component is to expose students to data sets where the interpretation of the data affects the conclusions drawn, exposing them to the ambiguity inherent in scientific investigation. Another key point here is that class time should not be dedicated solely to presentation of facts, but instead should expose students to the process of science, namely hypothesis generation, hypothesis testing, data analysis, and drawing scientific conclusions.

E9 – Student metacognitive development
This criterion addresses the degree to which instructors encourage students to reflect on their own learning or metacognition. Metacognition is defined as the process of setting challenging goals, identifying strategies to meet them, and monitoring progress toward them. For scores of 3 or 4, instructors integrate the practice of effective learning strategies supported by cognitive research and reflection on learning into course assignments and assessments. An example of a metacognitive assignment is asking students to review returned exams and correct their answers. The use of the term 'faculty' is meant as a generic term for the range of possible titles for instructors in any course that is part of the program being evaluated.

E10 – 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. The

lowest order cognitive processes focus on *knowledge and comprehension* and require students to memorize, name, label, define, arrange, classify, identify, restate, and select. The process of application requires students to apply, demonstrate, interpret, use, or solve. Higher order cognitive processes include *analysis* (requiring students to analyze, categorize, compare, contrast, differentiate, and test), *synthesis* (requiring students to compose, create, design, organize, and propose), and *evaluation* (requiring students to appraise, assess, defend, evaluate, judge, and predict).

E11 – Alignment of pedagogical approaches with evidence-based practices
This criterion is focused on the use of evidence-based practices in student learning. Two factors are being assessed here: first, the degree to which student-focused approaches are used in the classroom and second, the number of faculty members who are using these approaches. There is a wide range of student-focused approaches including use of student response devices (clickers) and group activities often associated with case-based or problem-based learning. To support claims of extensive use of evidence-based pedagogy, scoring of active learning using COPUS (http://www.lifescied.org/content/12/4/618.full) or other tools would be required to justify a score of 4. Counts of courses using evidence-based, active engagement strategies and inquiry vs. traditional lecture format would be appropriate evidence for scores of 2-3.

E12 – Awareness of national efforts in undergraduate STEM education reform
This criterion addresses the degree to which faculty members are aware of national reports on biology and STEM education like the 2011 AAAS *Vision and Change* report, the 2015 *Vision and Change: Chronicling the Change* report or the 2012 *Engage to Excel* PCAST (Presidential Council of Advisors on Science and Technology) report. Are faculty members aware of the HHMI Summer Institutes? Are faculty members interested and aware that these reports support making their classrooms student-focused and inquiry-based? Are faculty aware and willing to consider that there is strong evidence from educational and cognitive science studies that student-centered teaching strategies are more effective for learning than lecture-based teaching?

F.   LEARNING ACTIVITIES BEYOND THE CLASSROOM *(go to rubric)*

F13 – Intramural and/or extramural mentored research: student participation
This criterion pertains to the number of students that carry out mentored student research. Research here is intended to refer to research that takes place outside of formally scheduled laboratory classes or capstone courses. Examples include research with a faculty member from the institution, research with a faculty member from another institution, summer mentored research opportunities, or research opportunities with local biotech/pharmaceutical/environmental companies. To be considered, the student must participate in research for a minimum of one term or one summer. The student time commitment minimum is 10 hours per week for academic year work.

F14 – Supplemental student engagement opportunities
This criterion addresses whether the institution offers supplemental student engagement opportunities. These opportunities include 1) availability of tutoring (Are tutors available? Are there sufficient tutors to satisfy student demand? Are the tutors free for students or at least free for students on financial aid?), 2) Peer mentoring (Are there formal peer mentoring programs set up by the institution? These could be one-on-one programs or programs where a peer mentor works with multiple students.), 3) Supplemental instruction (This would include formal peer-led study groups that are associated with the class or extra class sections for students that need help mastering fundamentals.), 4) Academic advisors (Are academic advisors available for students? Are there sufficient academic advisors to meet student demand? Do students meet with academic advisors frequently enough to establish an effective and beneficial relationship?), 5) Learning communities (Are there opportunities for life science students to live/socialize together?), 6) Interest-based or career oriented clubs

(clubs organized around pre-health, pre-vet, biotech, pharma, life science majors. The effectiveness of these clubs can be assessed by the number of students that are actively involved or by the number of events they sponsor per year), and 7) Practicums and internships (this partially overlaps with F13 above, but here the practicums or internships are not strictly research-based, e.g. they could be more job or profession specific such as shadowing opportunities, co-ops, service learning, etc.). 'Institutionalized,' for a score of 4, refers to permanent funding for these opportunities.

G. INFRASTRUCTURE AND CLIMATE *(go to rubric)*

G15 – Flexibility of teaching spaces
This criterion is related to the quality of the actual teaching space. When estimating the percentage of classrooms, for the denominator, use the classrooms that are generally assigned to the department for teaching; for the numerator, use the subset that is flexible and reconfigurable. A flexible and reconfigurable classroom contains furniture that can be easily (and quickly) rearranged to accommodate student groups of different sizes. Single level classrooms are generally more conducive to active learning than tiered rooms. An example of a classroom that is not flexible and reconfigurable would be a lecture hall with multiple tiers and fixed seating.

G16 – Mechanisms for collaborative communication on significant educational challenges
This criterion addresses the degree to which stakeholders (faculty, staff, administrators, etc.) across the institution effectively communicate about nationally-recognized and institution-specific challenges and issues in undergraduate STEM 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 or working groups are likely to exist that actively engage key stakeholders across the institution around these issues. To achieve a score of 4, discussions that identify significant disparities or issues must lead to changes in programs to address those issues.

G17 – Teaching in formal evaluation of faculty
Formal evaluation includes regular/annual review, promotion, and tenure of faculty. Use of 'faculty' is meant as a generic term for the range of possible titles for instructors in any course that is part of the program being evaluated. Although all institutions value teaching, different institutions weigh components of faculty effort (e.g. teaching, research, service) differently. Student course evaluations are variable at different institutions. 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 evaluations are reviews by other faculty of teaching effectiveness and can include information about the strategies utilized and the level of student engagement. Scholarly teaching (scientific teaching) is the practice of evaluating whether students achieve learning goals and reflecting on teaching practices to continuously improve student outcomes.

PULSE Snapshot Rubric v2.0

Institution Type: _____ Institution Name: _____ Program/Department/Major: _____ Your Name (Optional) _____

	Criteria	0 (Baseline)	1 (Beginning)	2 (Developing)	3 (Accomplished)	4 (Exemplar)
A. INTEGRATION OF CORE CONCEPTS INTO CURRICULUM *(go to instructions)*						
1	**Integration of core concepts into the curriculum**	None of the core concepts are covered multiple times in the curriculum	One or two of the core concepts are covered multiple times in the curriculum	Three of the five core concepts are covered multiple times in the curriculum	Four of the five concepts are covered multiple times in the curriculum	All five core concepts are covered multiple times in the curriculum
Core concepts are: Evolution; Structure/function; Information flow/exchange/storage; Pathways and transformations of energy and matter; Systems						
B. INTEGRATION OF CORE COMPETENCIES INTO CURRICULUM *(go to instructions)*						
2	**Integration of core competencies into the curriculum**	Students are not exposed to any of the core competencies in significant detail	Students are exposed to one or two of the core competencies in significant detail	Students are exposed to three of the six core competencies in significant detail	Students are exposed to four or five of the six core competencies in significant detail	Students are exposed to all six of the core competencies in significant detail
3	**Extent of core competency integration into the curriculum**	None of the core competencies are covered multiple times in the curriculum	One or two of the core competencies are covered multiple times in the curriculum	Three of the six core competencies are covered multiple times in the curriculum	Four or five of the six core competencies are covered multiple times in the curriculum	All six of the core competencies are covered multiple times in the curriculum
Core competencies are: Process of science; Quantitative reasoning; Modeling and simulation; Interdisciplinary nature of science; Communication and collaboration; Understanding of the relationship between science and society						
C. COURSE LEVEL ASSESSMENT *(go to instructions)*						
4	**Linkage of summative assessments to learning outcomes**	Summative assessments are not linked to learning outcomes	Some courses have summative assessments that measure learning outcome achievement	Many courses have summative assessments that measure learning outcome achievement	The majority of courses have summative assessments that measure learning outcome achievement	The majority of courses have summative assessments that measure learning outcome achievement as part of a coherent, evidence-based assessment plan
5	**Evaluation of time devoted to student-centered activities in courses**	Time spent in student-centered activities is not measured	Time spent in student-centered activities is informally estimated at the end of term	Time spent in student-centered activities is documented by approximation after the fact in formal course evaluation at the end of term	Time spent in student-centered activities is informally tracked throughout the term and reported in formal course evaluations at the end of term	Time spent in student-centered activities is formally documented at points throughout the term and reported in formal course evaluations at the end of term
D. PROGRAM LEVEL ASSESSMENT *(go to instructions)*						
6	**Assessment of the six V&C competencies at the program level**	Competencies not assessed at the program level	Development of at least one of the competencies assessed at the program level	Development of 2-3 competencies assessed at the program level	Development of 4-5 competencies assessed at the program level	Development of all 6 V&C competencies assessed at the program level
7	**Use of 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

PULSE Snapshot Rubric v2.0

E. PEDAGOGY AND STUDENT HIGHER LEVEL LEARNING *(go to instructions)*

8	**Opportunities for inquiry, ambiguity, analysis, and interpretation in coursework**	Most courses, regardless of lab component, do not provide opportunities for inquiry, ambiguity, analysis, and interpretation; students have little exposure	25% or less of courses, regardless of lab component, provide opportunities for inquiry, ambiguity, analysis, and interpretation; a subset of students are exposed	~26-50% of courses, regardless of lab component, provide opportunities for inquiry, ambiguity, analysis, and interpretation; many student are exposed	Greater than 50% of courses, regardless of lab component, have opportunities for inquiry, ambiguity, analysis, and interpretation; most students are exposed	Opportunities for inquiry, ambiguity, analysis, and interpretation are the norm in all courses, regardless of lab component; nearly all students are exposed; many get multiple opportunities to practice
9	**Student metacognitive development**	Faculty do not guide students to reflect on and understand how to use learning strategies that are supported by cognitive research	Less than 25% of faculty guide students to reflect on and understand how to use learning strategies that are supported by cognitive research	25-50% of faculty guide students to reflect on and understand how to use learning strategies that are supported by cognitive research	51- 75% of faculty guide students to reflect on and understand how to use learning strategies that are supported by cognitive research	Greater than 75% of faculty routinely and intentionally guide students to reflect on and understand how to use learning strategies that are supported by cognitive research
10	**Student higher-order cognitive processes**	Exams and assignments across the curriculum are focused on the lowest-level cognitive processes (memorization/recall)	Exams and assignments across the curriculum are typically at lower cognitive levels, but may include understanding and application in addition to recall	Less than 25% of courses routinely challenge students to use higher-order cognitive processes (e.g., synthesize, evaluate, create) on exams and assignments	25-50% of courses routinely require students to use higher-order cognitive processes, but such practice is not yet ubiquitous across the curriculum	Work at higher cognitive levels is the norm across the curriculum, and instructors are adept at developing assignments and exams for practice at each level
11	**Alignment of pedagogical approaches with evidence-based practices**	Lecturing without student engagement is the dominant practice in all courses	Evidence-based pedagogies are used by one or few instructors	A core group of faculty are shifting department attitudes and practices toward more widespread use of evidence-based pedagogies, although courses in which students experience uninterrupted lecture are common	Nearly all faculty are learning about and experimenting with evidence-based pedagogical practices, although courses in which students experience uninterrupted lecture are a standard part of the curriculum	Majority of faculty routinely use evidence-based practices, so that students rarely sit passively listening to lectures for an entire class session
12	**Awareness of national efforts in undergraduate STEM education reform**	Faculty are isolated from the national dialogue	Pockets of awareness of the need for reform and national efforts exist	Greater than 25% of the faculty are aware of the need for reform and national efforts	Greater than 50% of the faculty are aware of the need for reform and national efforts	Greater than 75% of faculty are aware of the need for reform and national efforts in undergraduate STEM education

F. LEARNING ACTIVITIES BEYOND THE CLASSROOM *(go to instructions)*

13	**Intramural and/or extramural mentored research: student participation**	No students participate in mentored research	Less than 15% of students graduate with one or more summer/term of mentored research	15-30% of students graduate with one or more summer/term of mentored research	31-60% of students graduate with one or more summer/term of mentored research	Greater than 60% of students graduate with one or more summer/term of mentored research
14	**Supplemental student engagement opportunities**	Supplemental engagement opportunities are absent	One or two supplemental engagement opportunities are offered, but available to few students	More than two supplemental engagement opportunities are available, but only to a small subset (~25%) of students	Supplemental engagement opportunities are diverse, but capacity is limited (~50% of students)	Supplemental engagement opportunities are diverse, widely available to all students, and institutionalized

	G. INFRASTRUCTURE AND CLIMATE *(go to instructions)*					
15	**Flexibility of teaching spaces**	All assigned classrooms are lecture style with fixed seating	Less than 10% of assigned classrooms are flexible and reconfigurable to encourage student interaction	10-50% of assigned classrooms are flexible and reconfigurable to encourage student interaction	51-75% of classrooms are flexible and reconfigurable to encourage student interaction; different types of classrooms are available for diverse teaching styles	More than 75% of classrooms are flexible and reconfigurable to encourage student interaction; different types of classrooms are available for diverse teaching styles
16	**Mechanisms for collaborative communication on significant educational challenges**	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 stakeholders with infrequent, irregular meetings	Informal discussion of educational challenges that impact student success includes the majority of college stakeholders, but discussions are irregular	Formal communication mechanism such as a working group or committee exists for discussion of educational challenges that impact student success. The committee includes the majority of college stakeholders	Formal communication mechanism (working group or committee) exists for discussion of educational challenges that impact student success. The committee includes the majority of college stakeholders, who collaborate actively to make changes that have impact
17	**Teaching in formal evaluation of faculty**	Teaching is not considered in the evaluation of faculty	Teaching is considered a minor component in the evaluation of faculty, but is based solely on student course evaluations that assess only the student perception of the quality of the class and faculty	Teaching is considered an important component of the overall formal evaluation. Evaluation is based on both student course evaluations and peer evaluations	Teaching is considered a major component of the overall formal evaluation. Evaluation is based on student course evaluations, peer evaluations, and recognition of the importance of scholarly teaching	Teaching is considered a major component of the overall formal evaluation. Evaluation is based on student course evaluations, peer evaluations, assessment of learning gains, and recognition of the importance of scholarly teaching