

NAME: W&M HHMI Undergraduate Science Education Program

INSTITUTION: College of William and Mary

YEAR-LONG-RESEARCH-BASED LABS FOR Wren Scholars

| Inputs | Strategies | Outputs | Outcomes | | Impacts (Long Term) |
|---|---|---|---|---|---|
| | | | (Short Term) | (Medium Term) | |
| <p>Undergraduate Students - Wren Scholars</p> <p>Curriculum Development Teams (Faculty, Instructors, Postdoctoral fellows, and Graduate and Undergraduate Students)</p> <p>Biology Faculty - involvement of 4-6 faculty each year to teach lab course</p> <p>Phage Lab as the Paradigm</p> <p>Teaching and Research Laboratories</p> <p>Equipment and Supplies</p> <p>Institutional Commitment</p> <p>Supportive Teaching and Research Environment and Infrastructure: Teaching Seminars/Workshops/Lunch Meetings</p> <p>Charles Center Teaching Mentoring</p> <p>Faculty Release Time</p> <p>Department Curriculum Review Opportunities/External Review</p> <p>Biology Departmental Staff, e.g. lab coordinator, graduate teaching assistants</p> <p>HHMI – Staff, Leadership and Funding</p> <p>Other Funding Sources</p> <p>Undergraduates and graduate students engaged in curriculum development efforts</p> | <p>Develop new introductory labs to reflect new scientific discoveries and teaching approaches : focus on "hot topics" to "hook" students</p> <p>Involve different faculty members to present students with several different courses including: genomics of H. pylori and effects of mercury on behavior</p> <p>Ensure that new labs for Wren Scholars are integrated with faculty research and engage in authentic research</p> <p>Provide training opportunities and resources for faculty, lab coordinators, and graduate and undergraduate teaching assistants</p> <p>Provide support and tutoring for other science courses in which students are involved</p> <p>Introductory Lab” committee review of strategies and resources: ongoing as labs are developed</p> <p>Faculty teaching course will routinely ask how students are performing in other courses and how they are coping with freshmen year adjustments</p> <p>Faculty will integrate students into research culture of college by inviting them to seminars etc.</p> | <p>Institutionalization of research-based labs for all students from under-represented backgrounds - 50+ students</p> <p>Number and demographics of students taking labs developed under this initiative</p> <p>Development of lab manual for the labs; development of other materials to share and disseminate (powerpoints, exercises, protocols)</p> <p>Faculty and other instructors (lab coordinator and grad students) develop new skills</p> | <p>Students have better understanding of process of science, i.e, how new knowledge is produced</p> <p>Students have better understanding of the content covered in the lab</p> <p>Lab development activities have positive impact on curriculum developers and those who implement it</p> <p>Students are more interested and engaged in science issues and continue in science</p> <p>Implementation of new labs lead to new collaborations among faculty developing labs</p> <p>Labs lead to better attendance and attention in labs; better understanding in lectures.</p> <p>Students convert to and persist in STEM majors</p> <p>Students show more excitement and enthusiasm for research.</p> <p>Students show more command of math and quantitative approaches and willing to use and apply such approaches</p> | <p>Students have a long-term interest or engagement in science activities; they remain in science major</p> <p>More students enter research labs as undergraduates</p> <p>Students understand science concepts better and more importantly "how to do science"</p> <p>Those who took lab perform better in related courses and lab courses</p> <p>Faculty receive recognition for input into curriculum and teaching new course with reduced workload in other areas</p> <p>Faculty continue to be involved in modifying or developing courses with less or no HHMI support</p> <p>Institutional or other sources of support expand for curriculum development</p> <p>Additional faculty become involved in course development for introductory labs since new labs will have several components throughout the year</p> <p>Faculty use this lab as basis for upper level lab design—as a continuation of introductory labs</p> | <p>Students are engaged in continuing science-related activities and professions</p> <p>Students persist in science majors and in science careers at much higher levels; inspire their junior colleagues as well.</p> <p>Faculty develop a freshmen-through-senior research-based curriculum, expanding opportunities for research at all levels of the curriculum</p> <p>A cadre of faculty members lead a national movement to disseminate curriculum revision, especially incorporating research into courses/labs</p> <p>Curricular revision is spurred in all science departments</p> <p>Faculty receive recognition, awards, tenure, promotion for their efforts; Institutions reward faculty for better teaching and curriculum development activities</p> <p>Institutions commit funds and other support for curriculum revision</p> <p>Faculty and instructors continue to modify what and how they teach science, in particular introducing many more new courses that involve research</p> |

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| Evaluation Questions for OUTCOMES | Measures | Possible Data Collection Methods and Information Sources | Rank/Priority (include brief rationale) |
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| <ol style="list-style-type: none"> 1. How effective were the research-based labs in teaching contemporary science to students? 2. Did the students' attitudes towards research change for the positive? 3. How effectively did the students employ or engage in research beyond the course ? 4. What was the effect of the integration of research-based labs on the faculty and department/major? 5. What impacts were there beyond the department for the curriculum development activities - in particular on ultimate persistence in science? | <ol style="list-style-type: none"> 1. <ol style="list-style-type: none"> a. Students show increased interest in research b. Students learn introductory material better and retain material long term c. Students value research d. Students less wary of "real" research experiences e. Students continue in science (majors and careers) and continue in research 2. <ol style="list-style-type: none"> a. Students value research b. Students less wary of "real" research experiences c. Students continue in science (majors and careers) and continue in research 3. <ol style="list-style-type: none"> a. Students take additional courses with research component b. Students pursue research opportunities outside of course experiences 4. <ol style="list-style-type: none"> a. Course(s) integrated into curriculum b. Course enrollment increases c. Department student majors increases d. Department creates additional courses modeled on this lab 5. <ol style="list-style-type: none"> a. Lab courses in other departments employ similar strategy for introductory lab courses b. Effect on science pedagogy c. Additional curriculum development grants and awards that stress research-based approaches | <ol style="list-style-type: none"> 1,2. <ol style="list-style-type: none"> a. Pre-Post Tests; grades in courses/transcripts b. Entrance and Exit Questionnaire c. Interviews with individual students d. Focus Group e. CURE f. Course/Classroom Observations g. Course Surveys 3. <ol style="list-style-type: none"> a. Data collection on course/curriculum changes (e.g., Enrollment for students) b. Student data for independent research activities 4. <ol style="list-style-type: none"> a. Data on offerings in curriculum and departmental major b. Interviews/reports from faculty and other curriculum developers c. Focus Group of faculty and other curriculum developers d. Faculty CVs and portfolios 5. <ol style="list-style-type: none"> a. Review of course offerings, syllabi, and catalogs for research based courses b. Review of teaching workshop topics and teaching seminars c. Assessment of teaching on P&T d. Faculty CVs and portfolios e. Annual report of HHMI-funded activities and their impact f. Grant funding information g. Institutional funding reports h. Publications in science teaching journals | <p>Items are ranked based on how soon they can be captured during and after program activities (strategies) have occurred. However all questions and measures will be evaluated during and after each activity in order to capture the ongoing, longer-term changes in impact.</p> |