CALIFORNIA STATE UNIVERSITY EAST BAY

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COMMITTEE ON ACADEMIC PLANNING AND REVIEW

February 14, 2013
12-13 CAPR 14

TO: The Academic Senate

FROM: The Committee on Academic Planning and Review (CAPR)

SUBJECT: 12-13 CAPR 14: Five-Year Program Review for Statistics BS & MS and Biostatistics MS

ACTION REQUESTED: Acceptance of the Five-Year Program Review of the Statistics BS, Statistics MS, and Biostatistics MS programs in the College of Science at California State University, East Bay and the recommendation that they all continue without modification.

BACKGROUND:
At its meeting on February 2, 2012, CAPR invited members of the Department of Statistics and Biostatistics to orally present the outcome of their five-year review process completed in 2010-11 and submitted to CAPR for review in 2011-12 as prescribed in the Academic Program Review Procedures [08-09 CAPR 23 (revised)]. Department of Statistics and Biostatistics Chair, Dr. Eric Suess, had previously supplied the Senate Office with a full version of the program self-study, five-year plan, outside reviewer's report and program response to the outside reviewer's report. Prior to this meeting, the CAPR liaison to the Statistics and Biostatistics program review, Dr. Caron Inouye, examined the five-year review document and met with Dr. Seuss to discuss the plan and review. At the CAPR meeting, Dr. Seuss, who was accompanied by department member Dr. Lynn Eudey, presented a summary of the Statistics and Biostatistics five-year review to CAPR and participated in a question and answer session concerning the review.

Overview Description of the Program

The Department of Statistics and Biostatistics offers a BS in Statistics, MS in Statistics, MS in Biostatistics (which was formally approved as a Professional Science Master's degree in 2009), and two post-baccalaureate certificate programs. According to Fall 2009 enrollment data compiled by PEMSA, there were 20 undergraduate majors and 130 graduate students served by a tenure-track full-time equivalent faculty (FTEF) of 6.8, generating a full-time equivalent student (FTES) level of 299.6, an increase of 21.3% from 2005. In Fall 2009, the proportion of FTES taught by lecturers (FTES lecturer/FTES generated) was 25.5%, and the student-faculty ratio (all faculty) was 34.7. The BS in Statistics requires 68-77 units, and with 72 units of GE, falls well within the 180-unit requirement of the CSU.

Overview of the Documents Submitted to CAPR

The Department of Statistics and Biostatistics provides a report for all their degree programs,

including a detailed self-study (23 pages) which included a summary of their programmatic assessment strategies and data, five-year plan (7 pages), the external reviewer's report (7 pages), program response to external reviewer's report (5 pages), and eleven appendices (listed as A – K). The documents include the expected content for five-year review documentation as specified by the Academic Program Review Procedures. CAPR notes that a Summary of the Program is listed in the Table of Contents as being on page 4 of the review but was not included in the document submitted to CAPR; rather, page 4 is an outline of the documents submitted.

Program's Five-Year Review Self-Study

The Department of Statistics and Biostatistics provides a detailed self-study, including a summary of the previous five-year review and plan. The self-study provides thorough descriptions of the changes that have been developed and implemented since the last five-year review, notable achievements of the department, and areas of need and focus for continued improvements for the coming five years.

Curriculum

Since its last five-year review, the department has revised and significantly grown their programs. Programmatic revisions include the addition of the MS degree program in Biostatistics, which was formally approved as a Professional Science Master's degree in 2009; the elimination of the Theoretical & Applied and Biostatistics Options and the addition of the Applied Statistics Option in the MS Statistics degree program; and changing the department's name to Statistics and Biostatics to reflect the inclusion of the MS in Biostatistics. The department's graduate programs are among the largest in the College of Science, growing from 68 MS Statistics students in 2005 to 126 MS Statistics and MS Biostatistics students as of 2010. The undergraduate programs have also grown from 10 BS Statistics majors in 2005 to 26 majors (including double majors) and at least 25 minors in 2010. The department attributes much of the growth and success of their undergraduate and graduate programs to curriculum improvements, notably the separation of first-year graduate classes from undergraduate classes (formerly taught as two-tiered courses) and the creation of new courses specifically for the first year of the graduate programs. In addition, the department is unique within the CSU system in offering stand-alone Master's programs in both statistics and biostatistics.

The self-study details the department's important role in service to the campus by providing courses for other majors and the GE program. The department offers seven courses approved for GE credit in areas B4, D4, and B6. The B4 courses are required by all programs in the College of Business and Economics, most of the programs in the College of Science, and many programs in the College of Letters, Arts, and Social Sciences. In addition, the department offers their service courses, STAT 3010 Statistical Methods in the Social Sciences and STAT 3031 Statistical Methods in Biology every quarter.

Assessment of Student Learning

In order to evaluate the Department of Statistics and Biostatistics' assessment plan, the Suggested Scaled Rubric for Grading the Program's Student Learning Outcomes Assessment Plan from the Academic Program Review Procedures has been applied, and the department earns a CAPR score of 17.5 out of 21 points possible, with an average score of 2.5 out of 3 for each category, for the department's assessment of student learning.

Program Mission, Goals, and Objectives

The department provides thorough, clear descriptions of its mission in terms of educational purpose and goals for its MS in Statistics, MS in Statistics, and BS in Statistics in Appendices B – D, respectively (CAPR score 3/3 for Assessment Plan). For each degree program, overall student learning objectives/goals are stated in quantifiable/observable terms (e.g., "to carry out accurate and careful statistical analyses of real world problems and to express these analyses as the meaningful oral and written communication of statistical ideas"), as are specific competencies (e.g., "skill in using current computer technology for collecting, cleaning, and managing data, exploratory data analysis and the graphical display of data, inference and simulation studies"). (CAPR score 3/3 for Program Level SLOs)

Developing and Implementing Assessment Methods

The department provides clear descriptions of appropriate methods and strategies used to determine student achievement of programmatic student learning objectives (CAPR score 3/3 for Measurement). These strategies are linked to the stated program objectives as well as specific competencies. How course-level SLOs align with program SLOs (CAPR score 1.5/3 for Course Level SLOs) is not as explicitly described for the graduate programs as they are for the undergraduate program. For the BS in Statistics, a curriculum map is provided in Appendix D, showing in which courses the specific program competencies are introduced, reinforced, or emphasized. Specific competencies are placed into the major competency categories: Quantitative Reasoning, Critical Thinking, Communication, Computer Software, and Statistical Concepts and Technical Skills. Similar curriculum maps are not provided for the department's MS programs.

Appendices B – D include discussion of the pedagogical strategies ("best practices") that are aligned with program learning objectives and competencies, which instructional faculty members use to facilitate student learning. However, for the MS programs, it is not clear how specific course-level SLOs are linked with specific program-level SLOs. Sample syllabi are provided for select courses, e.g., STAT 6501 and 6502 (the two-quarter capstone experience for MS Statistics students), BIOSTAT 6653, and STAT 4601, but course-level SLOs and assessment strategies are not apparent in these syllabi. The best account of the alignment between course and program SLOs for graduate programs is in Appendix C, which states, "The biostatistics MS degree offers four courses dedicated to specific tools and practices in the field of biostatistics: STAT 6250 SAS Programming, BSTA 6651 Analysis of Categorical Data in Biostatistics, BSTA 6652 Survival Analysis in Biostatistics, and BSTA 6653 Clinical Trials in Pharmaceutical and Biomedical Industries." For future reference, a curriculum map and/or more explicit description of the alignment between course-level SLOs and program-level SLOs for the department's MS programs should be included in the review.

<u>Assessment Methods for Graduate Students</u>

The assessment tools used for the MS Statistics and MS Biostatistics programs are provided in Appendices B and C, respectively. The strategies used include a capstone experience (course or set of courses) and a two-part comprehensive examination of closed- and open-book exams. The closed-book exam measures comprehension and application of the specified programmatic skills/competencies, and the open-book exam measures hands-on application of skills related to computer technology/statistical methodology.

Assessment Methods for Undergraduate Students

Information regarding the assessment tools used for the BS Statistics program is found in pp. 12-13 of the self-study and in Appendix D. To assess BS Statistics students, a common set of 20 isomorphic questions (questions similar in skill/content assessed and difficulty level) is embedded in the final exams of *all* lower-division statistics courses. In addition, STAT 4601 Regression currently serves as an unofficial capstone experience for majors, in which student ability to communicate statistical concepts, for technical reasoning, and to identify/apply/interpret statistical modeling and data analysis in real-world contexts are assessed.

Assessment Results

Student assessment analyses (CAPR score 2.5/3) are described in a narrative accompanied by supplementary figures and tables (pp. 10-19 of the self-study). The self-study includes meaningful summary statistics of student learning analyses of its undergraduate majors, e.g. the percent acquisition of program SLOs divided into literacy, skills, and thinking categories; relationship between mean percent acquisition of program SLOs and type of instructor (annual, temporary, tenured, tenure-track); percent acquisition of topics covered (e.g. probability, inference, graphing) 1999-2004 and 2005-2010; and other analyses. Student assessment analyses for graduate students are relatively perfunctory and only data for student scores on comprehensive MS exams are presented.

Analysis of Results

The self-study contains logical, well-reasoned analyses of assessment results for undergraduate students, and conclusions are clearly presented and supported by the data (CAPR score 2.5/3). For example, assessment data reveal that increased faculty permanence/job security (categorized as temporary, annual, tenure-track, or tenured) significantly increased student scores on the 20 common core questions administered in all lower division statistics courses (Self-Study Fig. 1). Another good example of the analyses presented is the significant relationship between percent acquisition of program SLOs within a course and level of difficulty of that course's prerequisite; courses requiring calculus show higher levels of SLO acquisition than courses requiring only college algebra (Self-Study Fig. 6). However, analyses of the data and conclusions drawn from the data presented for the MS programs are absent from the self-study.

Use of Results for Improvement

The plan of the Five-Year Review for the department details the proposed improvements to their MS degree programs and BS degree program and minor. These proposed improvements are based on the self-study, APR data, and assessment results. For example, the department proposes the removal of STAT 3503 Statistical Inference II as a prerequisite to STAT 4601 Regression to facilitate an updated approach to the course content. The plan or self-study does not explicitly describe how the proposed improvements are linked to assessment data and it does not explicitly address whether the strategies of measuring student achievement of SLOs will be improved/revised along with the curriculum (CAPR score 2/3).

Other Areas of the Self-Study

As stated previously, the Department of Statistics and Biostatistics at CSUEB is unique within the CSU system in having stand-alone Master's degree programs in both statistics and biostatistics. Statistics graduate programs are typically offered through mathematics departments. Other than noting this information, the self-study does not expressly describe how course offerings compare to comparable CSU programs or how the course offering compare to nationally recognized programs.

As stated previously, the department's programs have all grown significantly since the last review period. Increased enrollment has not been matched by faculty hires. The self-study describes the loss of one full-time, tenure-track faculty member and one long-term lecturer. The department's request for a new faculty member for Fall 2011 was denied.

The self-study describes the department's reliance on Information Technology Services, access to computer labs for classes at all levels, the College web server, Blackboard, Google services, and access to computer software for students via the Virtual Computer Lab. Resources to students are also provided in the form of scholarships, e.g., the Bruce Trumbo Scholarship and the Statistics Department Scholarship. The self-study also discusses office staff in context of departmental resources and notes the loss of a 0.75 Administrative Support Coordinator position which puts tremendous strain on the 1.0 Administrative Support Coordinator/Office Manager.

The self-study does not include information about course offerings at the Concord Campus or about which courses (if any) are offered online. There is no discussion of whether issues of multi-cultural learning are relevant. Race and ethnicity data for statistics majors are not provided but referenced in Appendix F CSUEB Overall Enrollment by Ethnicity and Gender (made available electronically due to the large size of the Excel file).

Summary of Supporting Documents (Appendices)

The department's review documentation provides 11 supporting appendices (A – K). These appendices include the approved application to the Council of Graduate Schools for Professional Science Master's in Biostatistics (A); descriptions of the learning objectives, specific competencies, pedagogy, assessment strategies, departmental support, student preparation, course roadmap, and sample syllabi for the MS in Statistics (B), the MS in Biostatistics (C), and the BS in Statistics (D); CSUEB student enrollment data (E – G) noted as only available electronically; APR summary data 2005-2009 (H); the tenure-track faculty hire request/justification (I); a training presentation for faculty by Dr. Eric Suess on the use of the Virtual Computer Lab (J); and descriptions of the department scholarships (K).

External Reviewer's Comments and the Department Response

The external review of the CSU East Bay Department of Statistics and Biostatistics programs was conducted by Dr. Mary Ellen Bock, who has served as Chair of the Department of Statistics at Purdue University and as President of the American Statistical Association. She has acted as external reviewer for the department's last three reviews and has been instrumental in focusing the department's vision and guiding their change. She visited the campus on May 26-27, 2011.

Dr. Bock emphasizes (and the department clarified her comment) that CSUEB is the only CSU campus with a free-standing department of statistics and biostatistics and that, despite its small faculty size, the department has the largest graduate program in the College of Science that

competes successfully with other free-standing graduate programs across the nation. Dr. Bock considers this a unique asset of the College and University, as graduates are highly competitive in the workforce and are in particular demand in the Bay Area. Dr. Bock recommends the department increase the faculty size by five. She does not give quantitative justification for this number but offers compelling qualitative justification as follows:

- The low number of faculty members in the department is a barrier to continued delivery of the high quality graduate programs as student numbers remain high and is certainly an obstacle to any further growth of the programs, particularly in the field of computational statistics, a field that is in high demand from employers and an area of successful transition into Ph.D. programs.
- The low number of faculty members *and* support staff impedes the department's efforts to grow their BS program. The reviewer commends the department for their cooperation with local community colleges in providing a joint degree path in statistics but emphasizes that serious growth requires additional faculty and staff resources.
- The low number of faculty members negatively affects the number of statistical service courses that can be offered, which, in turn, negatively affects the ability of all students in all Colleges to think and reason quantitatively. Certainly, this has direct impact on the department's capacity to support CSUEB's mission and the collective efforts to help students achieve CSUEB's institutional learning outcomes.

The department concurs with Dr. Bock's report and recommendations but provides clarifications of some of the information in the report. The department has identified a list of priorities for the coming five years based on Dr. Bock's recommendations regarding faculty hiring and curriculum. These are described in the five-year plan submitted by the department.

Programs' Five-Year Strategic Plan (2011-2016)

The five-year plan for the Department of Statistics and Biostatistics is thorough and conforms to the format and content required by Academic Program Review Procedures. Priorities for the next five years include maintaining staff resources; recruiting new tenure-track faculty; recruiting BS and MS students; supporting faculty graduate advising; refining curriculum; developing new MS Statistics options in data analytics and data mining; developing a BS Statistics degree in computation, data analytics, visualization, and data mining; increasing support for service courses across campus, which would include developing new service courses to meet University needs; assessment of student learning, particularly undergraduate service and graduate levels; and maintaining bulletin boards for student recruiting.

Program Recommendations

Based on the strategic plan provided to CAPR by the Department of Statistics and Biostatistics, the following program-related recommendations are offered:

- The department should continue to make curricular changes in its MS degree programs in Statistics and Biostatistics.
- The department should continue recruitment efforts at the community college level, e.g. as by the Transfer Model Curriculum.
- The department should continue efforts at increasing use of computation in courses, e.g. as by

the Virtual Computing Lab (VCL).

- The department should provide more thorough analyses of student learning outcomes for the Master's programs in subsequent annual and five-year review reports.
- The department should continue to grow their graduate and undergraduate (major and minor) programs, providing additional tenure-track hires are granted.

Resource Recommendations

The primary concern for the coming five years is to satisfy the dire need for additional tenure-track faculty to effectively serve the growing enrollment, especially to sustain the rapidly growing demands of the Professional Science Master's (PSM) degree program in Biostatistics in the department. CAPR therefore proposes the following recommendations for the coming five years:

- The department should receive a minimum of three tenure-track positions to meet the growing demand for statistics instruction – maintaining option courses, dealing with increased class sizes (some enrollments at twice capacity), continuing to provide evening class options particularly for the graduate programs, and offering more service courses in statistics.
- The department should be allowed to recover lost office staff support.
- The department should be allowed release time for a faculty member to serve as a Graduate Coordinator to handle the advising needs of students in the growing MS Biostatics program.
- Release time granted to the Chair of the department should be restored to prior levels.
- The department should continue to work with Advancement to pursue private funding to supplement the Statistics Trust Fund and the Statistics Leadership Fund that are used to provide more scholarship opportunities; in the past, scholarship fundraising duties were a part of the administrative staff duties.

CAPR Recommendation(s) for the Continuation of the Programs

Acceptance of the Five-Year Program Review of the Statistics BS and MS and the Biostatistics MS programs in the College of Science at California State University, East Bay and the recommendations that these programs continue without modification.

Program's Next Five-Year Review: 2016-2017