ABSTRACT

This paper examines a prototype model for outcomes assessment of a Computer Science Program. The model explores correlating student’s scores on the Major Field Test (MFT) in Computer Science with academic performance. The model’s goal is identifying key factors (course offerings) and their contribution to MFT performance and student success.

INTRODUCTION AND PURPOSE

It is the time again. The ten-year anniversary of the Southern Association of Colleges and Schools (SACS) Accreditation Review is steadily approaching signaling another visitation and program review. Significant areas for this review include identifying program goals, objectives, learning outcomes, and methods for assessing how well an institutional unit meets those parameters.

Aside for anecdotal evidence and subjective evaluations through numerous questionnaires and surveys, there seems to be a dearth of quantifiable means for assessing program outcomes. This paper presents the rationale and methodology for a pilot study underway at Augusta State
University (ASU). Our goal is developing a quantifiable, replicable process for assessing ASU’s Computer Science Program.

BACKGROUND

The Computer Science Department at ASU undertook a curriculum review in the early 1990’s. The Association for Computing Machinery’s (ACM) Computing Curricula 1991 served as the guiding document. ASU, like many comparable small universities, must leverage a favorable student-faculty ratio, strong emphasis on teaching, and success of its graduates to overcome limited resources in faculty, equipment, and physical facilities. Thus the committee chose ACM’s recommend breadth-first approach tailored for small colleges/universities. Given limited resources, the fit was not exact but the committee was comfortable that program goals and objectives could be achieved.

The specific curriculum design used a matrix to map course content to “knowledge units” (KU) as defined in the Computing Curricula 1991 course listing (Tucker, 109-112). This provided a graphic representation of the overall curriculum and KU coverage. Out-of-balance situations were quite apparent resulting in several course realignments to provide the necessary coverage.

METHODOLOGY

Shortly after settling upon the curriculum, the department decided that CS majors should take the Major Field Test (MFT) in Computer Science, which is designed and administered by the Educational Testing Service. This particular instrument identifies and measures four computer science assessment indicators, an overall score, and student and departmental percentile rankings. Additionally, it closely parallels the Graduate Record Examination in content.

The outcomes assessment methodology is based upon the premise that the ASU CS curriculum maps reasonably well to material covered in the MFT. Certain subject areas, by necessity and design, receive stronger emphasis. Higher scores in those areas validate this. Mismatches between scores and perceived strengths, goals, and objectives, highlight areas for further investigation.

At present, we have approximately five years of MFT data. Our goal is two-fold: correlate student’s coursework performance with his or her MFT scores, and identify critical factors influencing the MFT CS assessment indicators (Programming Methodology, Software Systems, Computer Organization & Architecture, and Theory & Computational Mathematics).

The pilot model for achieving the first goal involves correlating a student’s grade-point-average, in major, with his or her overall score for total correct. This exercise is straightforward but does allow flexibility in the courses included in the computation. For example, do CS1 and CS2 merit inclusion? One might argue that autocorrelation exists between the two so perhaps CS2 alone is a better indicator. Should transfer work be included? Obviously there are many
other considerations, but, if a dominant course combination were discovered, it could provide insight in the most effective means to improve the program.

Initial GPA (independent variable) versus total score (dependent variable) appears in Figure 1. Although the scatter-plot suggests possible correlation, the correlation coefficient of 0.3536 portrays a less optimistic picture. The slope, 15.09, suggests marginal improvement in total correct at a rate of 15 more correct per unit increase in GPA. This is an interesting notion but it is somewhat diminished by the variability in the data. Regardless, we believe the data support the basic premise and merits further exploration.

Attaining the second goal is more difficult. The CS Assessment Indicator scores (mean percent correct) are aggregated for the group of students taking that particular MFT. Thus individual student scores are not available; furthermore, the indicators are not provided if fewer
than six students take the test. The latter is the predominant case for ASU’s winter graduations.

The initial plan for assessment indicator analysis requires developing an aggregate GPA derived from selected courses to determine whether or not these course clusters correlate to the Mean Percent Correct. If such an association exists, one can then extend MFT performance to gauge classroom instruction. For example, having established a relationship, assume a specific MFT assessment indicator score dropped while course grades remained at or above historical levels. This might be an indication of a shift in course coverage and need for realignment, insufficient rigor, or, albeit it unlikely, a shift in MFT coverage.

Figure 2 charts the four assessment indicators: Programming Methodology, Software Systems, Computer Organization & Architecture, and Theory & Computational Mathematics. Each indicator is measured by a subset of the MFT questions in a particular session. For example, the 1998 Computer Science II MFT was comprised of 60 questions, of which 13% determined Programming Methodology, 11% Software Systems, 12% Computer Architecture, and 17% Theory & Computational Mathematics.

CURRENT STATUS

As suggested by the title of this paper, data collection and analysis have really just begun. The preliminary results are encouraging, however in-depth analysis and “fine tuning” obviously remain to be done. The first step, already in process, is definition and refinement of GPA computations and identification of courses for inclusion.
Faculty are mapping course content to assessment indicators. Once complete, we can again construct GPAs and explore whether or not relationships exist between and assessment indicator and a particular course, or subset of courses.

SUMMARY

This pilot study defines a rationale and methodology to quantitatively measure outcomes of a CS program. While work is underway, much remains to be done. By tying recognized test instruments to classroom performance, ASU will have defined a basis for other institutions to undertake similar efforts. Regardless of the outcome, the ASU CS Faculty will have gained insight into how the various courses are woven into the fabric of the CS general curriculum and ASU’s program in particular.

REFERENCES