An Objectives-Based Approach to Assessment of General Education

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Abstract

This paper describes the development of an innovative strategy to assess how students and faculty perceive and accomplish the objectives of general education at Penn State. The University's general education curriculum is intended to achieve a number of educational goals, including the exploration and development of knowledge domains and skills that are consistent with, and complementary to, the learning outcomes associated with the students' major programs of study. A diverse team was assembled to evaluate three crucial aspects of general education, namely, its design, delivery and reception. The collaboration began with examination of course-taking patterns and framing of the University Faculty Senate's expressed objectives for general education in the context of the program goals and learning outcomes for selected technical and non-technical majors. Focused interviews with students and information solicited from course instructors were then used to gain an understanding for how these stakeholders actually view their experiences and course goals/delivery mechanisms, respectively, in terms of this objective-based matrix. A first attempt to implement an on-line methodology was made with limited success. The lessons learned shed light on the challenges and opportunities for scaling up a process that would allow efficient and widespread program assessment, across many disciplines of study, to facilitate academic advising and curricular improvement.

I. Origins of General Education Assessment at Penn State

Assessment of the general education program at Penn State has long been of interest at the University, owing to its prominence as a substantial component of the curriculum and degree requirements. The need for comprehensive assessment was articulated most specifically over a decade ago by a Task Force on Undergraduate Education charged by the provost in 1991.[1] A Commission for Undergraduate Education subsequently developed a plan for assessment in 1993,[2] and other reports on curricular coherence and relevance and assessment of educational outcomes followed in 1995 and 1996, respectively.[3,4] These initiatives focused, however, on surveying and encouraging the various motivations and methods for assessment within the independent disciplines, and the first call for broader application across the entire curriculum was issued as a key recommendation of the University's most recent general education reform effort in 1997.[5] The Special Committee on General Education emphasized the imperative to "institutionalize a process for formative assessment that is based on measurable outcomes, recognizes the importance of learning processes and informs continuous curricular

improvement." Other important characteristics of the assessment strategy suggested in that study were that it should be founded on the goals for teaching and learning; owned and implemented at multiple levels – by major programs and the principal "delivery" units; and geared, not at improving specific courses, but at the general education curriculum as a whole and the multi-dimensional opportunities it affords to students in meeting the career and life goals that they, as well as other stakeholders – faculty, future employers, etc.– deem important. The American Association for Higher Education espouses similar best practices for assessing student learning, including involvement of "representatives from across the educational community," and the use of approaches that "reveal change, growth and increasing degrees of integration," by focusing on *experiences* that lead to the expressed learning outcomes. As will be seen later, our design for assessment draws heavily on these principles.

Another fundamental change made to the general education program at Penn State was the emphasis on more active engagement of students in their own learning. The general education curriculum has always been and still is defined by skills and content areas or "knowledge domains," constituting a substantial 45 credits of the university-wide degree requirements. These include writing and speaking, quantification, health and physical activity, natural sciences, arts, humanities, social and behavioral sciences, and international and U.S. cultures. The new, Faculty Senate-approved requirement, however, stipulated that active learning elements should be incorporated into the delivery of *all* courses carrying general education credit, namely active use of writing, speaking and other forms of self expression; opportunity for information gathering, synthesis and analysis in solving problems and critical thinking; engagement in collaborative learning and teamwork; application of intercultural and international competence; and dialogue pertaining to social behavior, community and scholarly conduct. It was this feature of the Penn State general education that opened the door for an assessment process that begins with students' reflection on their experiences related to core competencies or involving in- or out-of-class learning activities.

II. Goals for General Education Assessment

The Team for Assessing Student Learning was charged in February 2004 under the Teaching and Learning Consortium (TLC), an arm of the University's Schreyer Institute for Teaching Excellence. The group's formation coincided with the development of a self-study for the University's accreditation review by the Middle States Commission on Higher Education, in which student learning outcomes were selected as an area for re-examination and strengthening. As part of this effort, a Web survey was conducted of all departments on their articulation of expected learning outcomes in undergraduate and graduate programs, as well as their assessment practices. Notably, responses were received for over half of the University's 252 baccalaureate programs, and over two-thirds of the respondents reported that they have explicitly defined and written learning outcomes (in contrast to the 24% who reported that they had such defined outcomes in an earlier 1993 survey). However, only a third of the programs reported that measuring achievement of general education goals is attempted as part of the assessment activity. The kinds of assessment methods included a wide variety of student, alumni and employer surveys and interviews, and to a lesser extent, portfolios, capstone projects and practica, and standardized testing. The survey also found substantial variability in the extent to which program outcomes were mapped to course goals and outcomes.

The assessment of general education curriculum has also been a stumbling block for even those programs subject to discipline-based accreditation review, such as Engineering, Business, Education and Nursing. For instance, while the College of Engineering has traditionally acquired course syllabi for many courses in the general education curriculum and mapped the course outcomes to the program educational objectives and outcomes articulated in the ABET criteria,[6] the prospect of assessment is complicated by a number of factors. First, in most cases the students are selecting courses in the various knowledge domains from a suite of over 300 approved general education course offerings. Second, although course proposals and their subject outlines are approved centrally by the University Faculty Senate, the specific topical content and course objectives, even for different sections of the same course, may vary significantly. Third, there is no formal mechanism for exchange of information regarding the expected outcomes for various degree programs as they may be addressed through the general education curriculum. And fourth, formal entry to the engineering majors occurs in the third or fourth semester, after students have already taken a substantial portion of their required general education courses. The disconnect between general education and the major programs may be further complicated by the multi-campus configuration of the University, where nearly half of the engineering students typically spend their first two years at 21 campuses distributed throughout the Commonwealth before entering their majors offered at only three of those campus locations.

The TLC Team was composed of representatives from a diverse mix of fields – faculty from engineering, education and liberal arts, instructional design and technology experts, statisticians, etc. – to tackle these inter-related problems. A first cut at the team charge was simply to assess how students meet the University's general education goals and how these intersect with specific program objectives and outcomes, providing recommendations on how the learning outcomes can be more effectively met through the current course electives. The approach to be used involved mapping students' experiences in the subset of courses most frequently taken to understand their motivations and the associations they make with defined program goals. To accomplish this, attention would be given to identifying the technology that would afford efficient and broad-based input from students in many different disciplines. The premise was that, by providing this information to course instructors, they will be able to evaluate their expected or desired course goals from the consumers' perspectives – both the enrolled students and the programs that rely on general education to further their accomplishment of selected educational objectives. And finally, the resultant assessment process/instrument was intended to:

(1) Encourage students to select courses and monitor their progress more coherently, with a better informed perspective of their programmatic, career and personal goals;
(2) Provide faculty with insight on broader expectations for their courses, held by all the various stakeholders; and
(3) Give academic advisers a valuable tool with which to help students meet their educational objectives.

The steps comprising the project were conceived as follows:

(a) Identify course-taking patterns to better understand how students in different programs of study are currently choosing to meet the general education requirements;

(b) Learn, through a limited set of individual interviews, what kinds of experiences – experiments, discussions, writing assignments, projects, etc. – students remember in conjunction with the courses they took, and how they see these as related to achieving the goals of general education and their majors;
(c) Collect and review the syllabi for the "popular" courses to survey the course goals and in- and out-of-class activities, and query instructors on how they perceive these as mapping to the general education objectives and goals for selected programs;
(d) Develop an on-line process that will permit scale-up, as well as providing a tool that is useful to students, course instructors and academic advisers.

The results of these efforts are discussed in the following sections. Emphasis is placed mostly on the *process*, and lessons learned regarding the assessment strategy as opposed to the actual findings, since the evaluation of results is still very much a work in progress.

IIIa. Course-Taking Patterns

The evaluation of course-taking patterns was conducted by querying the University's Data Warehouse, either by identifying the general education courses taken by several graduating classes, or by examining the frequency with which students are enrolled in the courses for recent semesters. For the purposes of this project, data were collected and contrasted for engineering students and liberal arts students.

Among engineering students, 16 courses of a total of 324 courses used to meet general education requirements account for 50% of all enrollments. The top 30 courses account for 67% of enrollments. For liberal arts students, the enrollments also tend to cluster around ten or so "most popular" courses in each of the knowledge domains – arts, humanities, and social & behavioral sciences. Interestingly, the courses elected by liberal arts majors are consistent with those preferred by the engineers. A variety of factors underlie these similarities. Students tend to select certain courses for reasons that include word-of-mouth from peers; preference for survey courses offering breadth, rather than depth, and the potential for anonymity in larger, lecture-format courses; prescription of particular courses by their majors (for instance, all engineering students must take economics in the social science category); the tendency of advisers to steer students to a subset of survey courses; and the popularity of several courses offered on-line, giving flexibility of scheduling and a unique learning environment.

IIIb. Student Interviews

The next step was to acquire perspectives from students on their experiences in general education as they relate to educational and career goals. The Team felt that, by first conducting a series of guided, one-on-one interviews, a better picture of how students process their curricular experiences could be generated, which would facilitate the development of an on-line approach for students to attempt this independently.

As a template for the interviews, the team developed a matrix of program outcomes (rows) vs. the general education objectives (columns) as shown in Figure 1. Engineering and French were chosen as the programs to be studied owing to their very different academic cultures and

professional settings. Engineering, of course, has prescribed program outcomes manifest by the well-known "a-k" ABET criteria. In the absence of outcomes dictated by the profession or accreditation, the faculty of the French Department was prevailed upon to articulate program objectives for its undergraduates. These included the skills, knowledge and attitudes needed to:

-- Speak, write, read and understand the language, culture and literature of France and the French-speaking world;
-- Build global understanding;
-- Be a cogent citizen in a foreign language;
-- Develop analytical skills;
-- Think critically about the written and spoken word;
-- Become rhetorically sophisticated.

In regard to the objectives for general education, The Penn State *General Education Guide*[8] for students states that "General Education, in essence, augments and rounds out the specialized training students receive in their majors and aims to cultivate a knowledgeable, informed, literate human being." So, in fact, the mission of the general education program is two-fold, recognizing that effective communication, quantitative and logical reasoning, and appreciation of the pluralistic nature of knowledge and aesthetic expression are important to the outcomes involving both the *career* and the *person* – to developing *professional* and more *general* intellectual curiosity and wholeness.

The prescribed objectives for general education include:

(1) acquisition of knowledge through critical information gathering, such as through library, virtual resources, scientific observation and experimentation, etc.;
(2) ability to analyze and evaluate that information, including quantitatively, as appropriate;
(3) integration of knowledge from a variety of sources and fields;
(4) making critical judgments, rationally and logically;
(5) developing skills to maintain health and understanding factors that impinge on it;
(6) communicating effectively both in and out of a particular discipline;
(7) seeking and sharing knowledge, independently and in collaboration with others;
(8) understanding international interdependence and cultural diversity;
(9) comprehending the role of aesthetic and creative activities manifest in both imagination and experience.

It is to be noted that each of the broad skill and knowledge domains corresponding to the above goals have associated detailed outcomes, as documented in the Guide to Curricular Procedures.[9]

Engineering students were recruited for the interviews, each conducted by two members of the Team – one serving as the interviewer and the other as observer/recorder. Six students were chosen from the volunteers to reflect different stages in their studies from the sophomore through senior years. Each of the interviews began with an explanation of the project. The student was shown the matrix with the eleven program outcomes forming the rows and the nine general education objectives constituting the columns, and given a brief explanation of their origin and meaning for the entries. Then each student was asked to select one outcome to work with first and to describe a learning experience or activity they remember, in- or out-of-class that had particular significance and relevance. The experience could be associated with any course they had (in the major or for general education) or could be related to extra-curricular activities

(participation in student organizations, design competitions, athletics, etc.) or to experiences such as work or study abroad, undergraduate research or teaching internships, co-operative education, etc. Only after describing the activity or experience were they asked what course it corresponded to, if in fact it was connected to a specific course. As the student worked through each row/column, identifying various experiences, activities and related courses, these were entered into the appropriate cells of the matrix by the interviewer and recorder. At the end of the 60-90 minute interview, the students were asked to comment on the process, including the value they might see as coming from the exercise and how we might encourage students reflect on their academic experiences and progress on a regular basis.

In all cases, both the interviewers and the students described the process as highly successful. The six students cited a total of 260 activities and assignments that were placed in one of the matrix cells, namely, the intersections of program outcomes and general education goals. As the interviews progressed, it was clear that the students were increasingly making connections among the various activities and the general education goals/program outcomes. Some connections that were expected by the interviewers were surprisingly absent. For instance, students did not cite activities related to mathematics with any frequency and did not see, or at least speak of, the application of math to their other courses. In general, more entries were made in the cells at the upper left of the matrix in Figure 1, than in the lower right.

A number of options were subsequently explored to analyze and interpret the collective student response. For example, the number or frequency with which the experiences were associated with the various cells was documented, along with the percentage of the total of all 260 reported activities, percentage of the row (program outcome) and percentage of the column (general education objective). These are displayed directly in the matrix, as illustrated by Figure 1. This allows for evaluation of which goals are being met and/or connected with one another, and where apparent gaps exist to be readily discerned. For instance, it is not too surprising to see that engineers frequently cite experiences related to application of science and engineering and the design/conduct of experiments (ABET outcomes “a” and “b”) and that these correlate strongly to the general education goals *1* and *2* that relate to knowledge acquisition and analysis of information. As another example, ABET outcome “j” relating to knowledge of contemporary issues is connected by students to the general education goal *6*, effective communication in and out of a particular discipline. In general, the content knowledge-based goals and outcomes got more attention than the higher-level analytical skills or integrative/interdependent knowledge domains (cells exhibiting primarily zeros in the figure). Although the sample size was not sufficient to allow it, it would be interesting to see if and how the matrices are different if documented separately for lower-division students and upper-division students, respectively.

Another approach to analysis involves “cluster” concepts, wherein the kinds of activities that students identify with “knowledge of contemporary issues” (program outcome “j”) can be associated with their experiences in courses such as history (HIST 001 & 002), labor and industrial relations (L I R 400), economics (ECON 002) and science, technology and society (S T S 100).

Frequency Percent Row Percent Col Percent	(1) acquire knowledge through critical information gathering	(2) analyze and evaluate the acquired knowledge	(3) integrate knowledge from a variety of sources	(4) make critical judgments	(5) develop the skills to maintain health	(6) communicate effectively	(7) seek and share knowledge independently and in collaboration	(8) gain an understanding of international interdependence	(9) comprehend the role of aesthetic and creative activities	Totals
(a) apply knowledge of mathematics, science, engineering	7 2.69 18.42 21.88	10 3.85 26.32 16.39	6 2.31 15.79 17.65	4 1.54 10.53 16.67	1 0.38 2.63 6.25	2 0.77 5.26 6.90	6 2.31 15.79 20.69	1 0.38 2.63 5.88	1 0.38 2.63 5.56	38 14.62
(b) design & conduct experiments, analyze data	5 1.92 17.24 15.63	10 3.85 34.48 16.39	5 1.92 17.24 14.71	2 0.77 6.90 8.33	2 0.77 6.90 12.50	0 0.00 0.00 0.00	2 0.77 6.90 6.90	1 0.38 3.45 5.88	2 0.77 6.90 11.11	29 11.15
(c) design a system, component, process	2 0.77 8.70 6.25	3 1.15 13.04 4.92	3 1.15 13.04 8.82	6 2.31 26.09 25.00	3 1.15 13.04 18.75	1 0.38 4.35 3.45	3 1.15 13.04 10.34	0 0.00 0.00 0.00	2 0.77 8.70 11.11	23 8.85
(d) function on multi-disciplinary teams	1 0.38 4.55 3.13	4 1.54 18.18 6.56	3 1.15 13.64 8.82	0 0.00 0.00 0.00	1 0.38 4.55 6.25	2 0.77 9.09 6.90	6 2.31 27.27 20.69	2 0.77 9.09 11.76	3 1.15 13.64 16.67	22 8.46
(e) identify, formulate, & solve engr. problems	3 1.15 13.64 9.38	9 3.46 40.91 14.75	2 0.77 9.09 5.88	4 1.54 18.18 16.67	1 0.38 4.55 6.25	1 0.38 4.55 3.45	1 0.38 4.55 3.45	0 0.00 0.00 0.00	1 0.38 4.55 5.56	22 8.46
(f) understand professional & ethical responsibility	3 1.15 15.79 9.38	5 1.92 26.32 8.20	1 0.38 5.26 2.94	1 0.38 5.26 4.17	1 0.38 5.26 6.25	4 1.54 21.05 13.79	3 1.15 15.79 10.34	1 0.38 5.26 5.88	0 0.00 0.00 0.00	19 7.31
(g) communicate effectively	3 1.15 7.14 9.38	6 2.31 14.29 9.84	3 1.15 7.14 8.82	2 0.77 4.76 8.33	1 0.38 2.38 6.25	11 4.23 26.19 37.93	4 1.54 9.52 13.79	5 1.92 11.90 29.41	7 2.69 16.67 38.89	42 16.15
(h) understand global & soc. impact	3 1.15 17.65 9.38	1 0.38 5.88 1.64	5 1.92 29.41 14.71	0 0.00 0.00 0.00	2 0.77 11.76 12.50	0 0.00 0.00 0.00	1 0.38 5.88 3.45	4 1.54 23.53 23.53	1 0.38 5.88 5.56	17 6.54
(i) engage in lifelong learning	1 0.38 6.25 3.13	4 1.54 25.00 6.56	3 1.15 18.75 8.82	3 1.15 18.75 12.50	3 1.15 18.75 18.75	0 0.00 0.00 0.00	1 0.38 6.25 3.45	1 0.38 6.25 5.88	0 0.00 0.00 0.00	16 6.15
(j) knowledge of contemporary issues	1 0.38 6.67 3.13	1 0.38 6.67 1.64	1 0.38 6.67 2.94	1 0.38 6.67 4.17	0 0.00 0.00 0.00	7 2.69 46.67 24.14	2 0.77 13.33 6.90	2 0.77 13.33 11.76	0 0.00 0.00 0.00	15 5.77
(k) ability to use techniques, skills, tools in engineering	3 1.15 17.65 9.38	8 3.08 47.06 13.11	2 0.77 11.76 5.88	1 0.38 5.88 4.17	1 0.38 5.88 6.25	1 0.38 5.88 3.45	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 0.38 5.88 5.56	17 6.54
Total	32 12.31	61 23.46	34 13.08	24 9.23	16 6.15	29 11.15	29 11.15	17 6.54	18 6.92	260 100.00

Figure 1. Student responses from the College of Engineering

IIIc. Evaluation of Course Syllabi and Instructor Input

Based on the course preferences, thirteen courses were selected for detailed examination. These included courses on theatre, cinema and music in the arts; American civilization, Western heritage, world religions, and basic philosophy in the humanities; and economics and introductions to psychology, sociology, and human development & family studies in the social and behavioral sciences.

The syllabi for these courses were collected and instructors or course leaders contacted in order to identify common course goals and activities that would characterize the typical general education experience. Not surprisingly, the course goals presented in the syllabi tended to be expressed in terms of introducing the terminology, major concepts and sub-areas, and the methods used in research and practice in the subject area. Writing assignments, readings and literature/internet research, group projects and presentations constituted the most common assignments. In general, however, many syllabi focused on teaching goals, rather than learning outcomes, and content rather than process.

The faculty members were also asked to complete the same matrix used in the student interviews and, like the students, demonstrated a tendency to want to put something in as many cells of the matrix as possible. The results shown in Figure 2 illustrate that many instructors set out to develop students' ability for effective communication (ABET outcome "g") and life-long learning ("i"), as well as their understanding of global and societal contexts ("h") and contemporary issues ("j"). In the matrix collecting student feedback, however, only the emphasis on communication is frequently reported by students.

IIId. Scale-up

The most recent phase of the project involved an attempt to scale up the assessment process to include more students. An on-line survey was developed to ask students to select an experience and then consider how it related to each of the general education goals and program outcomes. A box was provided for students to enter a brief description of the experience, and then they were asked to rate the activity on a 5-point scale, from "very applicable" to "not applicable" to each goal/outcome. The principal departure of this approach from the earlier student interviews was that each of the students was asked to consider only one, *given* course. Samples of 100 currently enrolled engineering students who (1) started their studies at either the Altoona or University Park campuses and are now in their 7^{th} or 8^{th} semester of study, and (2) had at some time, taken one of three selected courses, Economics 002, Psychology 002 or Theatre 100, were selected to receive the survey. The samples were chosen so that no student would receive a survey concerning more than one of the three courses; in other words, the total sample was composed of 300 different students.

Frequency Percent Row Percent Col Percent	(1) acquire knowledge through critical information gathering	(2) analyze and evaluate the acquired knowledge	(3) integrate knowledge from a variety of sources	(4) make critical judgments	(5) develop the skills to maintain health	(6) communicate effectively	(7) seek and share knowledge independently and in collaboration	(8) gain an understanding of international interdependence	(9) comprehend the role of aesthetic and creative activities	Totals
(a) apply knowledge of mathematics, science, engineering	3 0.78 12.00 5.77	3 0.78 12.00 5.56	3 0.78 12.00 5.66	3 0.78 12.00 5.88	0 0.00 0.00 0.00	3 0.78 12.00 6.00	3 0.78 12.00 7.32	4 1.04 16.00 8.89	3 0.78 12.00 8.57	25 6.48
(b) design & conduct experiments, analyze data	3 0.78 13.64 5.77	4 1.04 18.18 7.41	3 0.78 13.64 5.66	3 0.78 13.64 5.88	0 0.00 0.00 0.00	3 0.78 13.64 6.00	3 0.78 13.64 7.32	2 0.52 9.09 4.44	1 0.26 4.55 2.86	22 5.70
(c) design a system, component, process	4 1.04 13.79 7.69	4 1.04 13.79 7.41	4 1.04 13.79 7.55	4 1.04 13.79 7.84	0 0.00 0.00 0.00	4 1.04 13.79 8.00	3 0.78 10.34 7.32	2 0.52 6.90 4.44	4 1.04 13.79 11.43	29 7.51
(d) function on multi-disciplinary teams	6 1.55 19.35 11.54	4 1.04 12.90 7.41	4 1.04 12.90 7.55	4 1.04 12.90 7.84	0 0.00 0.00 0.00	4 1.04 12.90 8.00	3 0.78 9.68 7.32	3 0.78 9.68 6.67	3 0.78 9.68 8.57	31 8.03
(e) identify, formulate, & solve engr. problems	0 0.00 0.00 0.00	2 0.52 16.67 3.70	2 0.52 16.67 3.77	2 0.52 16.67 3.92	0 0.00 0.00 0.00	2 0.52 16.67 4.00	2 0.52 16.67 4.88	0 0.00 0.00 0.00	2 0.52 16.67 5.71	12 3.11
(f) understand professional & ethical responsibility	4 1.04 12.12 7.69	5 1.30 15.15 9.26	5 1.30 15.15 9.43	5 1.30 15.15 9.80	0 0.00 0.00 0.00	4 1.04 12.12 8.00	4 1.04 12.12 9.76	4 1.04 12.12 8.89	2 0.52 6.06 5.71	33 8.55
(g) communicate effectively	8 2.07 11.43 15.38	9 2.33 12.86 16.67	9 2.33 12.86 16.98	7 1.81 10.00 13.73	3 0.78 4.29 60.00	10 2.59 14.29 20.00	8 2.07 11.43 19.51	9 2.33 12.86 20.00	7 1.81 10.00 20.00	70 18.13
(h) understand global & soc. impact	6 1.55 16.22 11.54	6 1.55 16.22 11.11	6 1.55 16.22 11.32	6 1.55 16.22 11.76	0 0.00 0.00 0.00	4 1.04 10.81 8.00	3 0.78 8.11 7.32	5 1.30 13.51 11.11	1 0.26 2.70 2.86	37 9.59
(i) engage in lifelong learning	9 2.33 16.07 17.31	8 2.07 14.29 14.81	8 2.07 14.29 15.09	7 1.81 12.50 13.73	0 0.00 0.00 0.00	8 2.07 14.29 16.00	4 1.04 7.14 9.76	6 1.55 10.71 13.33	6 1.55 10.71 17.14	56 14.51
(j) knowledge of contemporary issues	8 2.07 12.70 15.38	8 2.07 12.70 14.81	8 2.07 12.70 15.09	9 2.33 14.29 17.65	2 0.52 3.17 40.00	7 1.81 11.11 14.00	7 1.81 11.11 17.07	9 2.33 14.29 20.00	5 1.30 7.94 14.29	63 16.32
(k) ability to use techniques, skills, tools in engineering	1 0.26 12.50 1.92	1 0.26 12.50 1.85	1 0.26 12.50 1.89	1 0.26 12.50 1.96	0 0.00 0.00 0.00	1 0.26 12.50 2.00	1 0.26 12.50 2.44	1 0.26 12.50 2.22	1 0.26 12.50 2.86	8 2.07
Total	52 13.47	54 13.99	53 13.73	51 13.21	5 1.30	50 12.95	41 10.62	45 11.66	35 9.07	386 100.00

Figure 2. Faculty responses from the College of the Liberal Arts

Unfortunately, the response rate was very poor: only 23 students completed the survey, or less than 10% of the total sample. Although the survey did not take long to complete, its timing was unfortunate, occurring at the end of the semester when students fill out in-class teaching evaluations for every current instructor, and the seniors are also sent a comprehensive exit survey. Another problem was that too much time had elapsed since some students had taken the courses, and they no longer remembered particular experiences or characteristics.

IV. Next Steps

The matrix approach that has been developed for assessing general education is based on the premise that students make connections among various parts of the curriculum through the experiences that have engaged them in active learning. By reflecting on how these experiences map to the expected objectives and outcomes of both general education and their major program, students can gain a sense of what progress they have made and what areas need more work. For the individual student and academic adviser, the completed matrix may be a useful and dynamic advising tool, helping to inform subsequent course selections and other academic pursuits.

The collective data from the students, at least as derived from guided interviews, can be important to the instructors of general education courses and those responsible for program curricular design. Through exposure to the program outcomes desired by their "customers," the faculty and academic units responsible for delivery of the general education curriculum become more aware of how their courses fit into the larger picture. Likewise, students may better appreciate the role these courses play in rounding out their education and supplementing their studies in the major in areas that will also be important in their professional careers.

Comparison of the students' entries in the objectives matrix to the entries made by the faculty who teach courses in the general education curriculum is also instructive, in that it illustrates the degree to which the intended goals are perceived as being met. Another useful assessment source could be the faculty teaching students *after* they have taken general education courses, to determine if students came prepared to perform the work that depends on skills and knowledge gained in the prior courses. This could not be done immediately after the general education course is taken, but would lag for the period of time necessary to find the students in later courses. Although the results would not be specific to a particular course or teacher, they could provide a credible assessment of broader outcomes, such as expected of the writing and speaking component of general education, for instance.

The attempt, so far, to scale up and automate the process is clearly a work in progress. There are probably a number of reasons for the low response rate to the on-line survey that was intended to populate the matrix. Querying students about their experiences in coursework should occur as soon as possible after the relevant courses are completed. If students are to use the matrix as a way to reflect on and assess progress, they need to make entries on a more or less continuous basis. Otherwise the task is too overwhelming.

The next phase of this project will refine the automated data collection by again surveying engineering students from University Park and Altoona who completed, in fall 2004, mirco-economics, macro-economics, or introduction to psychology. Additionally, a comparable survey will be administered to faculty who taught those courses to get their responses. These results will provide valuable information about courses as they are designed, delivered, and received. Additional attention will need to be given to establishing guidelines for academic advisers to use in coaching students and promoting the instrument's use. As more data are collected, the results may also prove very useful in curricular design to produce outcomes consistent with the program educational objectives.

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