AC 2007-1451: THE CLARKSON COMMON EXPERIENCE CURRICULUM: GRADUATION REQUIREMENTS BASED ON STUDENT LEARNING OUTCOMES

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The Clarkson Common Experience Curriculum: Graduation Requirements Based on Student Learning Outcomes

Abstract

Traditional graduation requirements have been composed of required and elective courses in a student's major together with courses selected to meet a "general education" requirement. With the growing emphasis on student learning outcomes, Clarkson University has adopted an outcomes based set of graduation requirements. .The *Clarkson Common Experience* unifies each student's learning in a major field of study with learning expectations that broaden the student's understanding of our modern world. Graduates are expected to meet outcomes in fundamental academic abilities, in personal and social development, and in prescribed areas of knowledge. While some outcomes may be achieved in a single course, the Common Experience Curriculum identifies four components that serve as common threads through multiple courses. These are: (a) learning to communicate effectively, (b) developing an appreciation for diversity in both working and living environments, (c) recognizing the importance of personal, societal, and professional ethics, and (d) understanding how technology can be used to serve mankind. Each of these components is introduced early in the curriculum, reinforced in subsequent courses, and emphasized in upper division courses. This curriculum also emphasizes professional development through outcomes in professional responsibility and ethics, and by engaging the student in a professional experience such as co-op, internship, directed research or other experiential learning activity related to the student's professional goals.

This paper presents a brief summary of the development process that led to the *Clarkson Common Experience Curriculum.* We discuss the relationship of this process to other curricular developments in higher education. The implementation of this curriculum, including the measures we have taken to ensure that the curriculum is sustainable and kept current, is described. Assessment of outcomes-based learning is vital to determining the overall success of this curricular change. We have just begun implementation during the 2006-07 academic year, and our plan will be phased over four years. We discuss our initial efforts and results of assessment.

Introduction

For many years Clarkson required all students to complete *The Foundation Curriculum* in addition to their departmental major requirements. It was a traditional distribution-based set of requirements intended to provide students with a broad background covering the sciences, mathematics, liberal arts, business and engineering. Prior to *EC2000*[1], it met the ABET criteria for course content in the humanities and social sciences.

With the introduction of the ABET *Engineering Criteria 2000 (EC2000)*[1] the emphasis on curricular evaluation shifted from a prescription of topical content to assessment of student learning outcomes. As part of *EC2000*, engineering curricula were required to demonstrate outcomes that went beyond those that might be expected from the traditional distribution of courses in the arts and sciences alone. As a way of fulfilling this requirement, we proposed that

graduation requirements should be based on outcomes, rather than a set of course distribution requirements. We initiated the discussion of what these outcomes should be by proposing a set of goals for all graduates.

Development of Outcomes

Our initial proposal originated from within the School of Engineering. With the ABET *EC2000*[1] criteria and the University's mission statement as starting points, we proposed a set of six goals for all graduates, not just engineering students. These goals were in addition to those required by a student's major department and are stated here:

Communication: Graduates should have the ability to communicate their ideas effectively using traditional written and oral presentations as well as using modern information technology.

Cultural Diversity: Graduates should have an understanding and appreciation for cultural and ethnic differences in the world and should recognize the value of these differences to society.

Responsibility and Ethics: Graduates should have developed a sense of personal integrity and responsibility, and exhibit these in their interactions with others, upholding the highest ideals of ethics and professionalism.

Societal and Technological Awareness: Graduates should have knowledge of contemporary issues and the ability to understand and evaluate the impact of continuing developments in science and technology on our global society.

Life-long Learning: Graduates should have the ability to assimilate and use new technologies and be prepared to engage in life-long learning.

Teamwork and Leadership: Graduates should have the ability to work productively within and lead diverse teams.

A faculty committee with representatives from all schools within the University was established by the Faculty Senate and was charged by the University President with developing a set of outcomes that would address these goals. A significant factor in bringing about this change was the support of both faculty and the administration as led by the University President. The committee began by asking the question, "What should our graduates achieve during their undergraduate education?" As might be expected, the initial work produced a long "laundry list" of desired outcomes. There were two key steps that led to a manageable set of outcomes and acceptance by the faculty. First, the outcomes were grouped into three broad categories of learning expectations: Academic Abilities, Areas of Knowledge, and Personal and Social Development. These learning expectations are broad categories into which the original set of goals has been incorporated. Effective communication clearly falls into the Academic Abilities area. Some goals are embedded into two areas; for example, goals associated with an appreciation for cultural diversity are part of the knowledge areas (learning about other cultures)

and part of the Personal and Social Development Area (appreciating the value of diversity). All of the original six goals are covered by learning expectations in one or more of the three categories. Second, the outcomes were integrated with major department requirements so that the overall graduation requirements were not simply an "add-on" to the student's major. Much of the work of merging, restating, and refining outcomes was done by a small, five-member campus team which participated in AAC&U's summer general education workshop. The workshop provided a focus on learning outcomes and assessment while also providing work time and access to experienced consultants at a critical stage in implementation planning. Table I summarizes the learning expectations and gives examples of specific outcomes for each category. Since there are more than fifty (50) outcomes, we have selected only a few representative examples.

Table I Learning Expectations and Example Outcomes

Learning Expectations	Example Outcomes
Academic Abilities ▪ Gain mastery of a major discipline ▪ Communicate effectively, producing and comprehending written, oral, and technological forms of communication in a variety of contexts ▪ Comprehend, analyze, and solve complex problems using both quantitative and qualitative reasoning ▪ Think critically and imaginatively	1. Student work should be well-organized and well-composed, factually and grammatically correct, effectively designed, and supported by appropriate evidence and documentation demonstrating competent information access, evaluation, and application. 2. Student work should demonstrate completion of progressively more complex problem-solving tasks showing competent information access, evaluation, and application
Areas of Knowledge ▪ Imaginative arts ▪ Cultures and societies ▪ Contemporary and global studies ▪ Economics and organizations ▪ Interrelation of science, technology, and society ▪ Economics and organizations ▪ Individual and group behavior	1. Students should analyze contemporary issues using appropriate concepts, methods, and tools of social and/or political analysis. 2. Students should analyze the allocation of resources for production and consumption and the implications for local and global development, sustainable growth, and the environment. 3. Students should analyze relationships among science, technology, and the health and welfare of humans and the environment
Personal and Social Development ▪ Increased understanding of and insight into personal behavior ▪ Appreciation of the need for self-motivated, life-long learning ▪ Increased social awareness and interpersonal competence, including an appreciation for the value of experiencing diversity ▪ Understanding of and recognition of the need for personal, societal and professional ethics	1. Students should demonstrate teamwork skills such as building effective relationships with peers, being a collaborative team member, and identifying and managing team conflict. 2. Students should identify moral and ethical dilemmas and problems in situations typically encountered within the student's profession, and provide an analysis of these from different ethical perspectives.

Curriculum Implementation

The Clarkson Common Experience provides for the liberal education of all of the university's students. Reforming the university general education program requires attention to state requirements, regional accreditation expectation, and the needs of specialized program accreditation such as ABET. The resulting curriculum requires changes in the approach to the liberal education of students by changing curriculum design and integrating general requirements with requirements of the major.

A principal goal of the revised curriculum has been to become more intentional in the way students and courses address expected learning outcomes. Under the old curriculum, students selected electives to meet distributional requirements without a real understanding of why such courses were required. These courses were often viewed as simply obstacles to be "gotten out of the way". Under the Clarkson Common Experience, students select electives which align with the established set of required outcomes. We believe it is important that students have an understanding of the purpose and the role each course plays in their overall educational program. The curriculum implementation should reflect a direct and visible connection among learning expectations, outcomes and specific courses. This connection is illustrated in Table II, and is evident in the course descriptions and syllabi that include a statement of specific outcomes.

Table II Learning Expectations and Required Course Work

Learning Expectations	Required Course Work
Academic Abilities ▪ Gain mastery of a major discipline ▪ Communicate effectively, producing and comprehending written, oral, and technological forms of communication in a variety of contexts ▪ Comprehend, analyze, and solve complex problems using both quantitative and qualitative reasoning ▪ Think critically and imaginatively	▪ Academic major ▪ The Clarkson Seminar (writing intensive) ▪ Communication points (six total), including two in upper division courses in the major ▪ Mathematics, including statistics ▪ Science (with integrated laboratory) ▪ Technology course
Areas of Knowledge ▪ Imaginative arts ▪ Cultures and societies ▪ Contemporary and global studies ▪ Economics and organizations ▪ Interrelation of science, technology, and society ▪ Economics and organizations ▪ Individual and group behavior	▪ Five courses across six areas of knowledge, including at least one interdisciplinary course meeting outcomes in two areas.
Personal and Social Development ▪ Increased understanding of and insight into personal behavior ▪ Appreciation of the need for self-motivated, life-long learning ▪ Increased social awareness and interpersonal competence, including an appreciation for the value of experiencing diversity ▪ Understanding of and recognition of the need for personal, societal and professional ethics	▪ First Year Seminar ▪ Professional requirement ▪ Professional experience ▪ Co-curricular activities

Required First Year Courses:

First-Year Seminar

First-Year Seminar treats personal and social development topics as well as Clarkson values, ethics and diversity.

The Clarkson Seminar

The Clarkson Seminar creates learning communities which focus on questioning received wisdom. The seminar introduces students to the role of values and ethics in culture and society, develops students' reasoning abilities through critical analysis of the beliefs and assumptions of their own societies and cultural traditions, and develops students' communication abilities through writing and discussion.

Knowledge Areas and University Courses

Students must achieve learning outcomes in six broad areas of knowledge listed below. The knowledge area requirement is met by completing five individual courses including one University Course that unites two areas of knowledge. University courses are multidisciplinary, and students observe and participate in the interaction of disciplines. Together, these courses must cover all of the following areas of knowledge: Cultures and Societies; Contemporary and Global Issues; Imaginative Arts; Science, Technology, and Society; Economics and Organizations; and Individual and Group Behavior.

Mathematics, Science and Technology Courses

Students must achieve learning outcomes in basic mathematics, science and technology by completing five courses in these areas. Students develop quantitative literacy through study in two mathematics courses appropriate to the major, including probability and statistics. Students develop an understanding of the principles of science and technology through two natural science courses, at least one of which must have an integrated laboratory component. Students gain an understanding of how technology is developed through a course that addresses the theme of technology serving humanity.

Integration with the Major Field of Study

A significant characteristic of the Common Experience is the integration of requirements from both outside and within a student's major field of study. It is the responsibility of each degree program to establish the learning outcomes necessary to demonstrate mastery of the discipline. In addition, each degree program must incorporate outcomes in the major courses that form part of the four threads which unify the general education requirements and the major. These threads are: the communication component, the diversity component, the ethics and values component, and the technology component. The details of these are described below. With the responsibility for meeting selected sets of outcomes placed, at least in part, in the major programs of study, program faculty have begun to revise courses and course requirements, especially addressing outcomes related to two broad sets of expectations: the professional requirement and the professional experience. The professional requirement is considered to be a way of guiding students toward the transition into the academic field and profession, whereas the professional experience is intended to be a culminating experience integrating academic and professional knowledge with the critical thinking and problem solving skills needed in the world of work.

Professional Requirement Outcomes

The professional requirement outcomes are the responsibility of each academic major program to incorporate as part of a student's major course work. Students should develop insights into their own behavior including the development of appropriate social interaction skills, such as listening to others and eliciting the views of others, and gaining an appreciation of the value of diversity in both living and working environments. Students should develop an understanding of personal, societal, and professional ethics. For example, students should understand and explain the concept of professionalism and professional responsibility, and describe how the student's professional community promotes, supports and enforces these concepts. Students should identify moral and ethical dilemmas and problems in situations typically encountered within the student's profession, and provide an analysis of these from different ethical perspectives. Students are expected to develop a set of personal, societal, and professional values to resolve the moral and ethical dilemmas and problems in their future professional, civic and personal lives.

Professional Experience Outcomes

The professional requirement outcomes are intended to prepare the student along the way toward his or her professional objectives. As a culminating experience, the professional experience reinforces these outcomes through project based learning such as a co-op, internship or other independent work experience. For the professional experience to be meaningful we expect students to develop an appreciation of the need for self-motivated life-long learning as demonstrated by understanding the need for continuously updating professional skills after graduation and learning effectively on their own. As part of the professional experience, students should develop an increased social awareness and interpersonal competence. Students should demonstrate leadership skills such as goal setting, change management, ethical behavior, and providing actionable feedback. They should also demonstrate teamwork skills such as building effective relationships with peers, being a collaborative team member, and identifying and managing team conflict. By completing the professional experience students are expected to gain an understanding of the value of service to the University, to the community, or to the profession.

Four Common Threads

Communication Component

Clarkson places a strong emphasis on developing students' abilities to communicate effectively in a variety of contexts using diverse forms of communication. To develop excellent communication skills, communication-intensive coursework is required, first in the Clarkson seminar, then across the curriculum and in the major. Courses and co-curricular activities may be assigned communication points - one or two - to indicate the level of communication activity involved. Beyond the Clarkson Seminar, students must select additional coursework and possibly co-curricular activities that total a minimum of six communications points with at least two points in major courses at the 300/400 level.

Diversity Component

From the moment they arrive on campus, Clarkson students prepare for the culturally diverse environments they will inevitably experience in their future careers. The First Year Seminar helps students respect and learn from Clarkson's diverse community. In the Clarkson Seminar

students question their own assumptions and consider different worldviews. Later in their academic coursework, students will gain a deeper understanding of cultural diversity within and among societies, recognizing how it influences their own actions and affects the lives of those around them. The professional requirement in the major area of study will prepare students to enter the global workforce by helping them understand the importance of diversity in the workplace.

Ethics and Values Component

Through a repeated emphasis on ethics and values, Clarkson promotes the reflection necessary to sustain personal, academic, professional, and civic integrity. Students are expected to view this process not just as an academic issue, but as critical for all aspects of their lives, including participation in community activities, sports, student organizations, and work. Issues of personal ethics and values are addressed in the First Year Seminar. Social and cultural values are part of the Clarkson Seminar. Courses in the areas of knowledge emphasize social and cultural values or philosophical and ethical issues. In the professional requirement, students identify ethical problems in situations typically encountered within their professions and analyze these issues from different ethical perspectives.

Technology Component

All Clarkson students are expected to understand the basis of modern technological society and to gain an appreciation for both the benefits and limitations of technology. Students are introduced to the basic knowledge necessary for understanding technology through mathematics and the natural sciences. A technology course reinforces this knowledge in the context of demonstrating how technology may be used to serve humanity. The interrelation of science, technology and society is studied as an area of knowledge. Finally, the major addresses information technology literacy appropriate to the discipline.

Curriculum Management

To implement the new curriculum and assure that offered courses and curricula progress toward meeting the Common Experience outcomes, responsibility for the new program was vested in a faculty committee with membership from each of the university's schools, a senior administrator, the registrar, and the chair of the institutional outcomes assessment committee. The committee reviews each course proposed to address outcomes in the various areas of the curriculum, including those courses in the majors meeting communication, technology, professional requirement, or professional experience outcomes. Course proposals must state how the course addresses the necessary outcomes and how the outcomes will be assessed. A regular cycle of course review (e.g., five years) is anticipated to assure that courses continue to address the necessary outcomes. The committee reports to the chief academic officer, works with the university's committee on curriculum and programs, and consults with the faculty senate as part of campus-wide outreach activities.

Relationships to Other Curricular Developments

The Common Experience curriculum was developed in parallel with other national initiatives focused on the general and liberal education of students. Once the Common Experience

outcomes had been defined, it became clear that a significant challenge would be implementing a curriculum (i.e. a set of courses) capable of addressing the outcomes. It was also clear that external evaluation and testing of the Common Experience approach would be needed. In the summer of 2005 a campus team was selected to attend the Association of American Colleges and Universities (AAC&U) summer institute on general education. The team's goals were to test and validate the approach that had been developed and to develop an implementation plan for a curriculum.

The organization of outcomes developed at Clarkson was clearly similar to the organization of learning expectations developed in AAC&U's Greater Expectations[2] project, and this underscored the plan for the final version of the curriculum. The team's work at the institute with workshop leaders from AAC&U and other institution teams helped to crystallize the final ideas for implementation. The Common Experience curriculum was seen to be integrated with the major, with key threads of learning introduced in the general education program and then subsequently reinforced and emphasized in the major. These outcomes follow, to a significant degree, recommendations[3] by Bok for the education of modern students: learning to communicate, learning to think, building character, preparing for citizenship, living with diversity, preparing for a global society, acquiring broader interests, and preparing for a career. In our view, the culminating "professional experience" for students should be an integrated learning experience[4] in which students synthesize learning from the general and major's curricula. Table III illustrates the similarity of the learning expectations developed in the AAC&U Greater Expectations project and the Clarkson Common Experience.

In an earlier white paper on liberal education in engineering,[5] Steneck, *et al*, considered three typical curriculum delivery models and recommended the integration of all three models. The Common Experience curriculum incorporates each of these models in its implementation.

Traditional Humanities and Social Science Courses: Courses addressing the various student learning outcomes in six areas of knowledge are predominantly from the humanities and social sciences disciplines. However, these courses must address specific learning outcomes in one or more of the knowledge areas, so the concept of humanities and social science courses, per se, is no longer relevant to the curriculum. Instead, the focus is on learning outcomes, not on specific disciplines or departments. The learning outcomes in the six areas of knowledge are clearly, but not exclusively, linked to the content and methods of inquiry in the humanities and social sciences.

Integrated modules: Courses taught by engineering (and other) faculty integrate communication, ethics, and teamwork in the curriculum in the major to address the communication effectiveness and the "professional requirement." Many courses in the areas of knowledge also integrate communication components as part of the points-based communication requirement, and "university courses" addressing outcomes in more than one area of knowledge could use integrated modules to meet the stated learning outcomes.

Table III Comparison of AAC&U Greater Expectations Project
and the Clarkson Common Experience Curriculum

AAC&U Greater Expectations	Clarkson Common Experience
Intellectual and practical skills ▪ Effectively communicate orally, visually, in writing, and in a second language ▪ Understand and employ quantitative and qualitative analysis to solve problems ▪ Interpret and evaluate information from a variety of sources ▪ Understand and work within complex systems and with diverse groups ▪ Demonstrate intellectual agility and the ability to manage change ▪ Transform information into knowledge and knowledge into judgment and action	**Academic Abilities** ▪ Gain mastery of a major discipline ▪ Communicate effectively, producing and comprehending written, oral, and technological forms of communication in a variety of contexts ▪ Comprehend, analyze, and solve complex problems using both quantitative and qualitative reasoning ▪ Think critically and imaginatively
Knowledge of human culture and the natural world ▪ Human imagination, expression, and products of many cultures ▪ Interrelations within and among global and cross-cultural communities ▪ Means of modeling the natural, social, and technical worlds ▪ Values and histories underlying US democracy	**Areas of Knowledge** ▪ Imaginative arts ▪ Cultures and societies ▪ Contemporary and global studies ▪ Economics and organizations ▪ Interrelation of science, technology, and society ▪ Economics and organizations ▪ Individual and group behavior
Individual and social responsibility ▪ Intellectual honesty ▪ Responsibility for society's moral health and social justice ▪ Active participation as a citizen of a diverse democracy ▪ Discernment of the ethical consequences of decisions and actions ▪ Deep understanding of one's self and respect for the complex identities of others, their histories, and their cultures	**Personal and Social Development** ▪ Increased understanding of and insight into personal behavior ▪ Appreciation of the need for self-motivated, life-long learning ▪ Increased social awareness and interpersonal competence, including an appreciation for the value of experiencing diversity ▪ Understanding of and recognition of the need for personal, societal and professional ethics

Interdisciplinary courses: Intersections among disciplines are evident in all aspects of life in our society, and exposure to such intersections is required in several areas of the new curriculum. Each student is expected to take at least one course addressing outcomes across two knowledge areas in the "university courses" after the interdisciplinary Clarkson Seminar. University courses are interdisciplinary and some may be team taught (see integrated modules, above). Many courses in the various areas of knowledge are also interdisciplinary, and technology courses are likely to span disciplinary boundaries. Some technology courses, for example, may be interdisciplinary with knowledge area courses covering contemporary issues or with courses covering the interrelation of science, technology, and society.

Assessment plan

As the Common Experience curriculum is implemented, components of the assessment plan are being developed and tested. Responsibility for planning and implementation rests with an institutional outcomes assessment committee, but certain components of assessment will take place as part of program efforts. Assessment is critical not only because of its clear linkage to the requirements of various external evaluators and accreditation bodies, but also because it measures how well students are meeting the expected outcomes so that course and curricular modifications can be made appropriately as needed.

The Common Experience curriculum will be implemented over a four year period. New requirements apply to students entering in 2006 and to subsequent cohorts. Students will be meeting the various outcomes over the course of the entire baccalaureate degree program, so some assessment approaches will be longitudinal while others will be course-based. In general, assessment of the cross-cutting themes (communication, diversity, ethics and values, technology) will be assessed longitudinally (i.e. over the course of the baccalaureate degree program). Examples of these different strategies are given below.

The Clarkson Seminar. The Clarkson Seminar is a thematically organized, communication-intensive course taught in small sections. This course provides the introduction to critical thinking outcomes and communication outcomes. Sections are organized around four themes, and students enrolled in the various themes are housed together (but not by section), forming basic learning communities supplemented by residence life programming. Initial assessment of communication effectives in the seminar is described below. Preliminary assessment of learning outcomes in this course focused on student self-assessment of writing improvement, critical thinking skills, interactions among the diverse group of first year students housed together by theme.

Communication Effectiveness. The ability of students to communicate effectively will initially focus on student writing. Cohort-based assessment starts from an initial writing sample (linked to summer reading and completed in the Clarkson Seminar). A stratified random sample of students will then be followed over the four year degree program, sampling student writing in senior-level courses in the major. A common assessment rubric has been developed and is being tested with writing samples from current students (comparing writing samples from the beginning and end of the Clarkson Seminar course). This rubric will be used in the longitudinal assessment and will be coupled to faculty development on writing assessment across disciplines.

Preliminary assessment of learning outcomes in the Clarkson Seminar focused on student self-assessment of writing improvement, critical thinking skills, and interactions among the diverse group of first year students housed together by theme. We surveyed students in the Clarkson Seminar and received responses from approximately half of the enrolled students. Approximately 62 percent of respondents agreed or strongly agreed that they had discussed the course and the books used in the course with students in their housing unit, but only 39 percent agreed or strongly agreed that having students in their course on the same floor improved their learning. Over 73 percent of respondents agreed or strongly agreed that the seminar course improved their ability to communicate in writing, and 64 percent agreed or strongly agreed that

the course improved their ability to analyze and critically evaluate ideas, arguments, and points of view. The results of the survey assessment will be coupled with faculty assessment of student writing, and the survey results are being used to revise co-curricular and residence life programming.

Areas of Knowledge. Courses approved for each of the areas of knowledge address a common set of student learning outcomes. Course-based assessments will be used to assess the quality of student performance in relation to the expected learning outcomes. Preliminary assessments are planned to use student knowledge surveys and comparable faculty surveys to evaluate the quality of student learning in the individual courses. The development of these surveys, which are necessarily limited in quality, will allow faculty to develop additional authentic assessments for the future.

Professional requirement and professional experience outcomes overlap and will be assessed as part of departmental assessment plans. Plans for the assessment of courses meeting mathematics, science, and technology requirements have not been completed, although assessment of student performance in introductory calculus, chemistry, and physics is already extensive. Ongoing assessment activities may need to be modified in accord with the stated learning outcomes in the Common Experience.

Summary

Few curricular reforms are more challenging than changing general education requirements. The Clarkson Common Experience has addressed this challenge by focusing on student learning outcomes, integrating learning expectations in the general education program with the major, and linking the general education program to the major through four common themes: communication, diversity, ethics and values, and technology. Learning expectations include academic abilities such as communication and critical thinking, bread of knowledge, and personal and social development, while attending to the professional development of each student.

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