

Work-in-Progress: A Structured Approach to Graduate Program Assessment

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Abstract: Graduate programs may use assessments in preparation for accreditation. There are numerous and significant challenges that underlie the assessment of technical graduate programs. Such challenges include the number of core courses taken by every graduate student, which is generally small, and the timeframe over which those courses are taken, which is normally three to four semesters. Such a program design precludes the outcome assessment typically associated with technical accredited programs at the undergraduate level. The approach taken at one Midwestern university is to evaluate the program at three levels. At the graduate school level, each student's graduate committee assesses that student on achievement in five categories of competence. In addition, the students are asked to self-assess their individual level of achievement when nearing graduation. These results are summarized at the program level. A third level is evidence-based. Data from courses is used in the assessment of competencies. The overarching structure is based on the graduate school learning competencies that were developed at the university level and are common to all graduate programs. Each department may then amplify the basic competencies to include outcomes specific to its programs. The level of achievement in each of the competencies is summarized in a department-level report. This report is reviewed with the graduate faculty and with the program's Industry Advisory Board to solicit inputs and suggestions for improvement. A culture of continuous improvement is facilitated through documentation of program improvement suggestions and disposition. This paper describes this structured approach that has been developed to facilitate graduate program assessment.

1. Introduction

Assessment of programs is a necessary component of accreditation self-studies and site visits. Graduate programs sometimes seek professional certifications in addition to their regional accreditations. While many undergraduate programs have been both regionally and professionally accredited for a number of years, graduate programs may be newer to the professional accreditation process. Graduate and undergraduate programs may apply for AABI¹ (Aviation Accreditation Board International) and ABET² (formerly known as the Accreditation Board for Engineering and Technology) accreditations. Typically, program accreditation criteria typically contain a list of student outcomes that range from five to ten objectives. These student outcomes are mapped to program educational objectives and to the curriculum. While additional accreditation criteria typically relate to admissions requirements, student advising, faculty qualifications, and composition and structure of curricula, student outcomes are the primary focus of the work presented here.

At one Midwestern university, the graduate faculty in aviation and aerospace management began assessment of its programs at multiple levels. This assessment process was undertaken as the faculty prepares the programs for professional accreditation from one or more professional

accrediting bodies. This paper describes the structured assessment approach that was employed and the outcomes of the initial assessment process using this approach.

2. Assessment of Graduate Program

The general approach to assessment taken at the particular university at which this research was conducted is to evaluate graduate programs at three distinct levels, as described below. The overall assessment framework is based on student competencies developed by the institution’s graduate school at the university level and that are common to all of the university’s graduate programs. Each department may then augment these basic competencies to include outcomes specific to its programs. These competencies are shown in Table 1. In Table 1, the program-level competencies amplify the university-level competencies and add specificity in the descriptions to include terms that apply to the department’s particular programs. This step aids in the development of assessments, as the descriptions are specific to the program.

Table 1.
University and Program Level Graduate Competencies

University Level Graduate Program Competencies	Program Level Graduate Program Competencies
Communication: To be able to effectively communicate their field of study.	Communication: Students will effectively articulate current trends, issues, and challenges with high quality papers, presentations, and theses.
Critical Thinking: To think critically, creatively, and to solve problems in their field of study.	Strategic Thinking: Students will effectively employ strategic thinking to solve problems in aviation and aerospace management.
Professional Development: To demonstrate attributes of professional development consistent with expectations within their field of study.	Leadership and Professionalism: Students will demonstrate a mastery of leadership and professionalism concepts that embody teamwork, ethical behavior, and social responsibility.
Knowledge and Scholarship: To build the capacity to identify and conduct original research, scholarship or creative endeavors.	Aviation/Aerospace Management Technical Competence: Students will demonstrate expert knowledge, skills, and ability in aspects of aviation safety, sustainability, and quality management.
Ethical and Responsible Research: To demonstrate the ability to conduct research in an ethical and responsible manner.	Analytical and Responsible Research Competence: Students will demonstrate competency in the application of quantitative, qualitative, and other analytical techniques as well as responsible and ethical conduct of research.

The first level of assessment consists of the assessment of each graduate student by his or her committee on achievement in five categories of competence. Each of the five primary

competencies may then be mapped to one or more related student outcomes, which may in turn be linked to criteria for determining whether the student's proficiency level can be categorized as developing, emerging, or proficient. Employing these proficiency level descriptors is recommended in order to provide a common reference point for assessment purposes³.

In order to properly delineate the three distinct stages of development of knowledge, skills, and abilities (KSAs) that graduate students are expected to acquire as they achieve increasing degrees of proficiency within a particular graduate program, appropriate proficiency level descriptors are suggested. These descriptors represent graduate student knowledge, skills, and abilities development across a continuum of cumulative proficiency, and should assist with the classification of those KSAs across that continuum by facilitating the identification of what the student should know and be able to accomplish upon entry to and exit from each of the three levels. These levels represent stages of development, beginning with the competencies the students possess when entering the program and concluding with those that they take away as they transition to the "lifelong learning" phase. The descriptors may be used to guide both the instructional process and the development of graduate curricula⁴.

The three suggested proficiency level descriptors for aviation management programs are as follows⁵:

- 1. Emerging:** Students within this category generally make rapid progress, learning basic graduate-level research skills for immediate needs, as well as beginning to employ appropriate academic terminology.
- 2. Developing:** Students within this category are challenged to increase their research abilities in an increasingly greater number of situations, and to learn a wider variety of terminology, applying their knowledge and skills in a more cultivated manner appropriate to their level of experience.
- 3. Proficient:** Students within this category continue to learn and apply a range of high-level skills in multiple and varied of frames of reference, including comprehension and synthesis related to advanced technical projects. This stage is indicative of a high degree of engagement in required academic tasks across a broad range of content areas.

The student outcomes relative to each of the three descriptors may be described using appropriate Revised Bloom's Taxonomy action verbs⁶. For example, the first two Bloom's levels, *Knowledge* and *Comprehension*, would map to the *Emerging* proficiency level descriptor suggested here. Related action verbs are such terms as *define*, *describe*, etc. The mapping of the six Bloom's Taxonomy levels to the three proficiency level descriptors is relatively straightforward; the *Application* and *Analysis* levels are mapped to the *Developing* proficiency descriptor, and the *Synthesis* and *Evaluation* levels are mapped to the *Proficient* descriptor.

As applied to graduate program assessment, and using a specific example of assessment of the Communication competency, the levels of proficiency may be described as:

- Emerging – Understands and selects appropriate communication tools, gathers information, able to deliver content on more than one platform. Able to critique their own work.

- Developing – Integrates communication modes, and logically organizes written and spoken thoughts. Effectively critiques their own work and that of others. Arguments are well organized.
- Proficient – Effectively selects and combines communication strategies for application to professional frameworks and theories. Able to interconnect and extend knowledge from multiple disciplines. Arguments are skillfully presented.

The level of proficiency may then be assessed by collecting evidence of communication such as papers and presentations from specific courses.

In another example, Analytical and Responsible Research Competence, the levels of proficiency may be described as:

- Emerging – Demonstrates an understanding of basic analytical techniques used to conduct research as well as ethical research considerations.
- Developing – Applies basic analytical techniques to research studies that result in a presentation or paper.
- Proficient – Demonstrates proficiency in a wide variety of analytical techniques to produce a high-quality paper or presentation for a professional audience.

The level of proficiency may be assessed by collecting evidence of analytical and responsible research such as grades from tests and projects from specific courses on research methods and research analysis. An example of an assessment for "Emerging" proficiency is the completion of the university required Responsible Conduct of Research certificate. This may be assessed in the graduate level research methods course. While certificate completion is a binary measure, it serves as a necessary foundation for advancement to the subsequent two proficiencies. Required papers and presentations from other courses may be used to assess "Developing" and "Proficient", depending on the complexity of the analysis conducted. These descriptors are intended to be used as a guide for faculty for purposes of instruction and curriculum development relative to differentiated instruction in academic content areas.

At the second level of assessment, the students are asked to self-assess their individual level of achievement when nearing graduation. These results are summarized at the program level. This is accomplished by distributing links to an electronic survey and asking students to complete a self-assessment using Likert-scale items corresponding to a perceived achievement level in each of the five competency areas. On this scale, 1 is developing, 2 is satisfactory, 3 is good, and 4 is strong. Note that this scale does not correspond to the proficiency levels described above; this is because the scale is a legacy assessment tool and it is desirable to be able to compare results across years for the professional accreditation process. Once that process has concluded and accreditation obtained, the scale will be changed to match the proficiency levels. The summary of the results is presented in a bar graph (not depicted here) showing the number of respondents in each competency and each level of proficiency.

A third level of assessment is evidence-based. Data from courses is used in the assessment of competencies. The level of achievement in each of the competencies is summarized in a department-level report. This report is reviewed on an annual basis with the graduate faculty and with the program's Industry Advisory Board to solicit inputs and suggestions for improvement. A

culture of continuous improvement is facilitated through the documentation of program improvement suggestions and dispositions. The continuous improvement process is depicted in Figure 1.

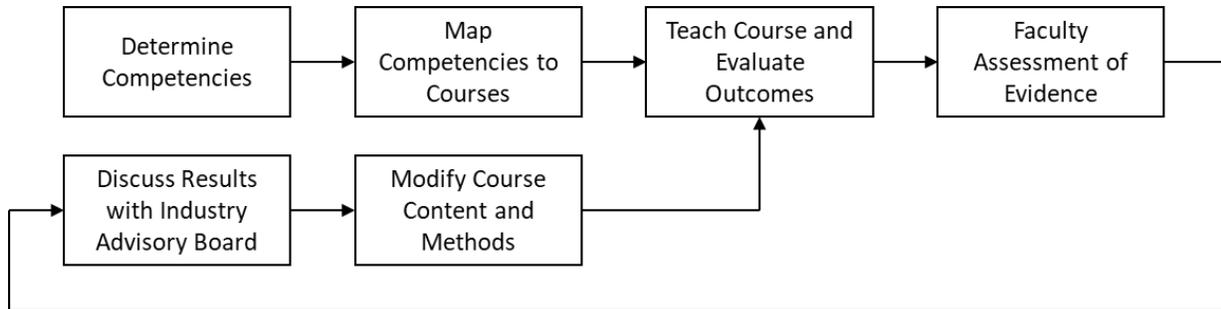


Figure 1. Graduate program continuous improvement process.

3. Challenges

There are numerous and significant challenges that underlie the assessment of technical graduate programs. Such challenges include the number of core courses taken by every graduate student, which is generally small, and the timeframe over which those courses are taken, which is normally three to four semesters.

In an undergraduate program, there may be eight semesters totaling 120 credit hours taken over a four-year period. This type of program makes it possible to assess learners in a longitudinal manner; i.e., to assess them at several points in their progress through their undergraduate degree. The normal prerequisite structure of undergraduate courses assists in the acquisition of knowledge, skills, and abilities by the students in a progressive fashion, and facilitates the assessment of proficiency in terms of the suggested proficiency level descriptors of developing, emerging, and proficient.

A master's program of typically three to four semesters limits the ability to longitudinally assess student outcomes typically associated with technical accredited programs at the undergraduate level. For instance, a non-thesis MS student will take a minimum of 30 semester credit hours, typically taken as 10 three-hour courses over three semesters. Because of the nature of the specific graduate program at this university, there are two required courses for all MS students, and then the remaining eight courses are selected by the student's graduate committee chair along with the student. This structure allows for highly customizable plans of study for students, and allows them to develop discipline specific knowledge that support their future career goals. The difficulty is that the levels of proficiency that may be determined through course-level data is rather problematic to assess. For instance, a course may consist of 20 students, each of whom is in his or her first semester, second, third or final semester. While it is possible to track individual students separately, that approach may require some effort on the part of faculty and may suggest the need for more complex data management systems and additional personnel to manage student portfolio data.

4. Path Forward

Assessing the highly customizable graduate programs continues to be a challenge. Additional ability to better assess graduate programs in a longitudinal manner may result from the implementation of self-contained graduate certificates. These certificates are typically nine to twelve semester credit hours. Such certificates could be “stacked” in such a way as to comprise the graduate degree completion of a coursework-only program, or near-completion, in the case of a thesis-based program. A student would be able to finish the degree by completing multiple certificates. By structuring the degree in this manner, assessment could be granularized by examining the level of proficiencies competencies attained in the certificates.

5. Summary

This work presents a means of assessing on three separate levels the student competencies attained in a general graduate program at a Midwestern university. By assessing the program in this manner, using the mapping techniques and proficiency level descriptors presented herein, it is anticipated that the overall assessment of graduate program competencies will be facilitated, leading to substantive advances in the continuous improvement process prescribed by various regional and professional accrediting organizations.

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