Assessment Plan

for

Financial Engineering

Departments of
Agricultural Economics & Economics
And
Mechanical & Industrial Engineering

May 2017

Table of Contents

Introduction

The purpose of this document is to detail the procedures for ensuring continual improvement of the Financial Engineering (EFIN) program at Montana State University. Included are activities necessary for the program's accreditation by the Northwest Commission on Colleges and Universities. Beyond the requirements for accreditation, a culture of continual improvement is necessary to support the University's vision to "be the university of choice for those seeking a student-centered learning environment distinguished by innovation and discovery in a Rocky Mountain setting."[1] As the state's land-grant university, MSU "educates students, creates knowledge and art, and serves communities, by integrating learning, discovery, and engagement." Accordingly, the mission of the Financial Engineering program is:

> To produce graduates well-grounded in financial engineering and data analytics knowledge and skills consistent with the land-grant mission of MSU; and prepare them to be productive citizens and contributors to the economic well-being of employers.

Program Educational Objectives

In support of the program's mission, the Financial Engineering Steering Committee (FESC) has established a set of educational objectives based on the needs of the program's constituents. Educational objectives describe, broadly speaking, what graduates are expected to attain within a few years after graduation. The faculty-approved educational objectives in support of the program's mission are as follows.

Financial Engineering graduates will:

I. Employ financial engineering, risk management and data analysis tools and knowledge in their chosen career paths;
II. Employ effective communication;
III. Work in inter-professional teams;
IV. Engage in life-long learning, including post-graduate education for some graduates;
V. Contribute to industry and society, including involvement in professional and other service activities; and
VI. Demonstrate ethical leadership in design and operational activities that contribute to their organization and community.

In accomplishing our educational objectives, we are committed to wise stewardship of resources through assessment and public accountability. The Program Educational Objectives are consistent with MSU's mission to provide a challenging and diverse learning environment in which the entire university community is fully engaged in supporting student success and to provide an environment that promotes the exploration, discovery, and dissemination of new knowledge, since our students would be unable to attain our educational objectives without this

[1] See: http://www.montana.edu/opa/policy/MissionBozeman.html

consistency. All of us work together to provide the learning environment that supports student success, being mindful that **students** are our most important product.

For example, Objectives III, IV and VI are consistent with the University mission to provide a collegial environment for faculty and students in which discovery and learning are closely integrated and highly valued through engagement. Inter-professional teams of faculty and students on campus are one example of this preparation to function well on such teams in industry or elsewhere after graduation. This is also consistent with the College of Engineering's mission to integrate learning and discovery and develop and share technical expertise; and the M&IE Department's mission to serve the State of Montana, the region, and the nation by providing outstanding leadership and contributions in knowledge discovery and student learning.

As another example, Objectives V and VI support MSU's mission to serve the people and communities of Montana by sharing our expertise and collaborating with others to improve the lives and prosperity of Montanans. This is consistent with the department mission to serve the State of Montana by providing outstanding leadership and contributions in knowledge discovery, student learning, innovation and entrepreneurship, and service to the community and profession. For graduates to successfully lead and serve our communities, they must be able to communicate well (Objective II) and have valuable tools and knowledge that they can share (Objective I).

In summary, our educational goals and missions are consistent, since we are committed to education, research, and service to our constituencies. We value our students and are dedicated to prepare them to become the leaders of the future. In addition, we believe in pursuing new knowledge and sharing it with our constituencies.

Program Constituencies

The primary constituencies for the Financial Engineering (EFIN) program are:

- Current EFIN students
- EFIN graduates
- Employers
- Financial engineering, economics and business graduate programs
- Financial Engineering affiliated faculty

Secondary constituencies are the faculties of programs that offer courses taken by EFIN majors, such as: business finance faculty, computer science faculty, and statistics faculty.

Although not listed as primary constituencies, the following groups are also constituency groups that we serve, and from whom we receive feedback:

- Families of students
- Financial Engineering External Advisory Board
- DAEE Advisory Committee
- M&IE Departmental Industrial Advisory Board
- COE Engineering Advisory Council

The needs of the primary constituencies align well. Faculty members want to produce graduates who are informed, productive citizens and valued employees. They also hope to attract and prepare graduate students to join their research groups. Current students are pursuing a financial engineering education with the expectation that they will be competitive on the job market and be able to land a rewarding job upon graduation. Many also expect to be prepared for graduate study, whether they pursue a graduate degree immediately upon graduation or sometime later. Graduates from the program desire to be seen as value-adding in whatever pursuits they may be engaged, whether a professional working in an international company, or a graduate student in an engineering or business graduate program, or co-owner of a start-up company. Employers are looking for associates who will be valued members of their communities and contribute significantly to the economic well-being of their companies, while faculty in graduate programs desire technically competent graduate students who can communicate well, learn independently, and play well with others.

We glean a lot of insight into the needs of our constituents through the several advisory bodies because most of the members of these boards hire, supervise or interact with analysts and other professionals with knowledge and skill sets of financial engineering graduates. So what do employers look for? First, employers need deep technical knowledge and analytical skills (Objective I), and they need their people to work well in inter-professional teams (Objective III). Second, even though technical expertise is important, it can be severely limiting if the individual is not able to take a systems viewpoint and see the larger picture (Objectives V and VI) and be able to communicate across disciplinary boundaries (Objective II). Third, technology and markets are changing rapidly, and it has become more important than ever for today's engineer to be able to acquire new knowledge and learn new skills (Objective IV), and the faster, the better! Fourth, all progressive companies are hiring today for tomorrow's leaders, and they have a need to become ever more efficient and effective in their operations (Objective VI). And finally, many of today's companies value community service and support the efforts of their people in service to their profession.

Most of the objectives that serve employers' needs so well, also address the needs of programs of graduate study. In particular, Objectives I – IV directly address the attributes of a successful and productive graduate student: strong grounding in discipline, good communication and teamwork skills (especially multidisciplinary), desire for and an ability to engage in independent learning, and a desire to make significant contributions to the broader community.

Since the objectives expressly meet the needs of prospective employers and of graduate programs, they also serve the needs the students and graduates of the program. Students do not, in general, pursue a degree for its own sake, but rather as a springboard to the next phase in their lives, be it a career or further education. Thus, the program educational objectives serve student needs as well.

Review Process for Program Educational Objectives

The FESC considers review and modification of program educational objectives a natural part of the program's continual improvement efforts. The committee reviews program educational objectives every three years, normally at the start of the fall semester, in light of the university,

college and departmental missions along with any other trends affecting our primary constituents and any changes to engineering accreditation criteria.

If any modifications are made and approved by faculty consensus, the program's External Advisory Board reviews the revised objectives and provides feedback. The EAB meets once annually. If large changes are made, the faculty also seeks the input of current students through an open forum where students have the opportunity to review the changes and offer comment.

In addition, the faculty periodically administers surveys to alumni and to employers of our graduates in which they are asked to rate the relevance of our program's educational objectives to the needs of industry. Surveys are administered every 3-5 years. The most recent alumni survey was conducted in 2013 and the most recent employer survey was conducted in 2015.

Finally, the faculty review job placement of recent graduates annually. Seniors are asked to complete a job placement survey before they graduate which includes contact information. Survey data are entered into an alumni database. Students who do not indicate they have a job at graduation are contacted approximately three months after graduation to learn of their job or graduate school status. Job placement statistics are tallied by the coordinator for this item and presented to faculty at a faculty meeting for discussion.

Student Outcomes

Student outcomes describe what students are expected to know and be able to do at the time they graduate from the program. They encompass the knowledge, skills and behaviors that students acquire as they progress through the program and which prepare them for professional careers and graduate study. The faculty has defined the ten student outcomes that follow.

Students completing the Financial Engineering program will demonstrate:

(a) an ability to apply knowledge of mathematics, science, economics, and financial engineering;

(b) an ability to design financial instruments and risk management strategies, as well as to analyze and interpret data;

(c) an ability to function on inter-professional teams;

(d) an ability to identify, formulate, and solve financial engineering problems from a systems perspective;

(e) an understanding of professional and ethical responsibility;

(f) an ability to communicate effectively;

(g) the broad education necessary to understand the impact of financial engineering and risk management solutions in a global, economic, environmental, and societal context;

(h) a recognition of the need for, and an ability to engage in life-long learning;

(i) an ability to use the data analysis and modeling tools necessary for financial engineering and risk management; and

(j) an ability to design, develop, implement, and improve integrated systems.

Relationship of Student Outcomes to Program Educational Objectives

The student outcomes outlined above prepare Financial Engineering graduates to attain the program educational objectives, as shown in the table below. An "X" in a cell indicates that the outcome supports attainment of the objective.

Table 1: Map of Student Outcomes to Program Educational Objectives

	Program Educational Objectives					
Student Outcomes	**I**	**II**	**III**	**IV**	**V**	**VI**
(a)	X			X		
(b)	X			X		
(c)			X		X	X
(d)	X	X	X		X	X
(e)	X		X		X	X
(f)	X	X	X	X	X	X
(g)	X		X		X	
(h)	X			X	X	X
(i)	X	X	X	X		
(j)	X		X			X

Objective I, Utilize financial engineering, risk management and data analysis tools and knowledge in their chosen career paths, is supported by all outcomes but one because the financial engineering toolkit and knowledge base include some aspect of each of the student outcomes.

Objective II, employ effective communication, is most directly supported by Outcome (f), which is an ability to communicate effectively. This objective is also supported by Outcome (d) because students will become better communicators as they understand problems from a systems perspective, and by Outcome (i) because data visualization is essential to effective communication in this field.

Objective III, work in inter-professional teams, is supported most directly by Outcome (d) which is an ability to function on inter-professional teams. However, it is also supported by Outcome (f) because good communication skills are essential to good teamwork, and by Outcome (e) because being a good team player involves understanding one's professional responsibility and behaving in an ethical manner. This objective is further supported by Outcomes (d), (g), (i) and (j), each of which focuses to some degree on a systems-level understanding that is much broader than the particular technical aspects of the issues being faced. This systems-level understanding

enables our graduates to more aptly grasp the perspectives of other disciplines, which should enhance their ability to participate meaningfully in multidisciplinary teams.

Objective IV, engage in life-long learning, including post-graduate education for some, is directly supported by Outcome (h) which is a recognition of the need for, and ability to engage in life-long learning. Furthermore, the ability to engage in life-long learning, especially if one desires to pursue post-graduate education, is significantly enhanced with a strong foundation in the fundamentals of math, science and engineering (Outcome (a)) and an ability to use modern engineering tools (Outcome (i)). Finally, this objective is supported by Outcome (b) because students can use experimentation to generate new knowledge, and analyze and interpret data to acquire new insights.

Objective V, contribute to industry and society, similar to Objective I, is supported by nearly all of the outcomes. The outcomes noted in Table 1 as supporting this objective together, in concert, support attainment of the objective that our graduates contribute in meaningful ways to the advancement of their industry and of the broader society.

Objective VI, demonstrate ethical leadership in design and operational activities that contribute to their organization and community, is perhaps most directly supported by Outcome (j) (the ability to design, develop, implement, and improve integrated systems) since all organizations, regardless of industry sector, rely on integrated systems to provide their services and goods. However, to attain this objective requires teamwork (c), communication (f), and good problem-solving skills (d) coupled with a strong sense for ethical responsibility (e) and a strong desire for life-long learning (h).

Review Process for Student Outcomes

Similar to program educational objectives, the FESC considers review and modification of student outcomes a natural part of the program's continual improvement efforts. The committee reviews student outcomes every three years, normally at the start of the fall semester, in light of the university, college and departmental missions along with any other trends affecting our primary constituents and any changes to engineering accreditation criteria.

If any modifications are made and approved by faculty consensus, the program's External Advisory Board reviews the revised outcomes and provides feedback. If large changes are made, the faculty also seeks the input of current students through an open forum where students have the opportunity to review the changes and offer comment.

Data Collection

Two categories of data are collected to help the program assess relevance, currency, and preparedness relative to industry and societal needs. One set of data concerns the program objectives and general program direction, while the other focuses on student outcomes.

Objectives and Program Direction

To evaluate the relevance and importance of program objectives as well as program direction, the FESC collects data from the following sources:

1. Job placement data from program graduates within 6 months of graduation, collected annually.
2. External Advisory Board review. An advisory board consisting of working or retired professionals in the field meets annually to review the program and provide input.
3. Interviews with students who have returned from an internship experience, conducted annually.
4. Survey of alumni three to five years post-graduation, administered every three years.
5. Curriculum review by FESC, conducted every three years.

Outcomes

To assess the degree of attainment of the program's Student Outcomes, the FESC collects data from the following courses:

6. Senior exit interviews, conducted annually with graduating seniors.
7. Course reviews of required courses, conducted on a three-year rotation.
8. Embedded outcome assessments of student work products produced in required courses.

Senior exit interviews are conducted at the end of the senior capstone course (EFIN 499) using a self-efficacy survey of outcomes plus a semi-structured group interview using pre-formulated questions. Students may also provide written responses to the survey questions.

Course reviews are conducted by reviewing the syllabi, learning objectives and summative assessments (e.g., final exams) of all required economics, industrial engineering and financial engineering courses. Approximately six courses are reviewed per year, which allows the FESC to review each course every three years.

Assessment of Student Outcomes (a) – (j) using student work products from select courses is conducted such that each outcome is assessed at a minimum of every three years. Student work is evaluated by at least two committee members other than the instructor, using a rubric designed specifically for the assessment of that outcome. The follow table outlines the courses in which data will be collected for specified outcomes.

Table 2: Outcomes Data Collection in Courses

Outcome	EFIN 301	EFIN 401	EFIN 499	EIND 300
(a)		*		
(b)	*			
(c)			*	
(d)	*			
(e)				*
(f)			*	
(g)		*		
(h)	*			
(i)		*		
(j)			*	

Schedule

The following table outlines the schedule for data collection for the next four academic years.

Table 3: Four-year Data Collection Schedule

	F17	Sp18	F18	Sp19	F19	Sp20	F20	Sp21
1. Job Placement		X		X		X		X
2. EAB Review	X		X		X		X	
3. Internship Interviews	X		X		X		X	
4. Alumni Survey						X		
5. Curriculum Review								X
6. Senior Exit Interviews		X		X		X		X
7. Course Reviews		EFIN 301 EIND 373 ECNS 301	AGBE 467 EIND 300 ECNS 309	EFIN 499 EIND 464 ECNS 313	EFIN 401 EIND 354 ECNS 461	EFIN 101 EIND 457 EGEN 325	EIND 468 EIND 364 ECNS 345	EFIN 301 EIND 373 ECNS 301
8. Embedded Outcomes Assessment		b,d,h	e	c,f,j	a,g,i			b,d,h

Program Evaluation

Evaluation is the set of processes used for interpreting the evidence collected through assessment and determining the extent to which student outcomes are being attained. Evaluation results in decisions and specific actions regarding program improvement. The faculty of the Financial Engineering program is committed to continually improving and updating the undergraduate curriculum.

Review of Assessment Plan

In order to keep the various elements of the assessment plan current, the FESC has created the following review calendar:

Table 4: Assessment Plan Review Schedule

	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Objectives	X			X		
Outcomes	X			X		
Course-Outcome Map	X			X		
Rubrics		X			X	
Data Collection Schedule			X			X

Evaluation of Assessment Data

Once data has been collected, the FESC reviews the data to ascertain the level of attainment of outcomes, and decides on any corrective actions required. The FESC also monitors the effects of changes implemented. In general, the data are evaluated in the semester following the one in which data were collected (see evaluation schedule below).

Table 5: Four-year Evaluation Schedule

	F17	Sp18	F18	Sp19	F19	Sp20	F20	Sp21
1. Job Placement			X		X		X	
2. EAB Review	X		X		X		X	
3. Internship Interviews	X		X		X		X	
4. Alumni Survey							X	
5. Curriculum Review								X
6. Senior Exit Interviews			X		X		X	
7. Course Reviews			EFIN 301 EIND 373 ECNS 301	AGBE 467 EIND 300 ECNS 309	EFIN 499 EIND 464 ECNS 313	EFIN 401 EIND 354 ECNS 461	EFIN 101 EIND 457 EGEN 325	EIND 468 EIND 364 ECNS 345
8. Embedded Outcomes Assessment			b,d,h	e	c,f,j	a,g,i		

Documentation of Continuous Improvement

A designated member of the FESC creates an annual report summarizing the assessment activities, data collected, evaluation results, and actions taken during the previous academic year.

Summary

In conclusion, the Financial Engineering program at Montana State University has established a set of educational objectives and student outcomes for the program. The faculty follow systematic procedures for reviewing the educational objectives for relevance and adequacy, and for assessing and evaluating the extent to which graduates are attaining student outcomes.