IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Self Study Report Spring2008

Industrial Technology Program

Agricultural Systems Technology Program

March 18, 2008

Agricultural and Biosystems Engineering Department
102 Davidson Hall
Ames IA 50011-3080

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INTRODUCTION

This document has been prepared as the departmental response to the program standards developed by the National Association of Industrial Technology (NAIT) for the accreditation of baccalaureate programs in industrial technology. The report is being submitted to the NAIT visiting team in March 2008 to provide background information for their site visit to the Iowa State University campus April 16, 17, and 18, 2008, when they will review the Bachelor of Science in Industrial Technology program for re-accreditation and the Agricultural Systems Technology program for accreditation.

Copies of the report are also being provided to other individuals who have an interest in the department and its programs. Readers who are not familiar with the NAIT accreditation program and details of the accreditation procedures may find it helpful to refer to the Industrial Technology Accreditation Handbook 2006 published by NAIT, 3300 Washtenaw Avenue, Suite 220, Ann Arbor, MI 48104-4200. The Department has elected to be reviewed using the Outcomes Assessment and Accreditation Model for Industrial Technology Program (*Revised 1-15-08/J. Sutton/Coscarelli 1-27-08*). The specifics of this accreditation model are not located in the Handbook but are accessible directly from NAIT.

The preparation of this report has been a shared responsibility, involving the entire faculty and staff of the Agricultural and Biosystem Engineering Department. However, the Agricultural and Biosystems Engineering department’s Technology Curriculum Committee has played a key role in this effort. The Chair, Chuck Schwab, and committee members have assumed primary responsibility for compiling information, word processing and reviewing successive drafts of the manuscript, and managing the production of the report.

Sylvia Anderson, Thomas Brumm, Joseph Chen, Melody Carroll, Valerie Evans, Steve Freeman, Steve Mickelson, and Chuck Schwab made significant contributions to the compilation and development of various sections of the report. Instructors of all TSM courses have provided course materials and background information needed in the preparation of the report. The collaborative efforts of these engaged individuals have facilitated the many aspects of writing, editing, and producing the report. Thanks to each of them for contributing to the success of this endeavor.

Ramesh Kanwar
Professor and Chair

PREFACE

In 2002 the Industrial Technology program was administered by the Industrial Education and Technology Department located in the College of Education. The Agricultural Systems Technology program was administered by Agricultural and Biosystems Engineering department located in the College of Agriculture. Since 2002 there have been several major changes that occurred at the university, college, and department levels. These types of changes are not common at universities and offered many challenges along the way.

On July 1, 2004, the Industrial Education and Technology Department merged with the Agricultural and Biosystems Engineering department. The two technology curricula are now administered by one department and one college but kept as separated degree programs. On July 1, 2005, the College of Education merged with the College of Families and Consumer Sciences to form the College of Human Sciences. Only on July 1, 2007, the College of Agriculture underwent a name change to the College of Agriculture and Life Sciences.

Throughout these major changes the departmental faculty kept a constant watch to maintain the same or better quality learning experiences and opportunities for the student selecting the Industrial Technology or Agriculture Systems Technology degree programs. It is our belief that the Agricultural and Biosystems Engineering department was successful in merging our departments, managing the transition for those students caught amidst these major changes, and strengthening these technology programs even further.

Because of the timing of the merger approval, the University Catalog for 2005-2007 could not reflect all the possible changes and so a transitional step was instituted. The curricula for both programs were modified using the existing Agricultural Systems Technology (AST) and Industrial Technology (ITec) courses. None of the courses were allowed to be changed until next catalog cycle. In the fall of 2007, the University Catalog 2007-2009 carried for the first time the completed merged version of curricula for Industrial Technology and Agriculture Systems Technology degree programs under the new Technology Systems Management (TSM) courses that are shared by both programs. As the department begins the editing cycle for the 2009-2011 University Catalog, it is now clear that our planning and process was effective.

One additional challenge for our department is managing the transition from our old building to new facilities being planned. The timing of our neighbor's (Chemistry Department) new facility has provided our department with some unique challenges of space and logistics. Two of our teaching facilities are scheduled for destruction before the construction of our new facility will be started. The courses and projects in those building are being relocated to other facilities on temporary basis. These temporary facilities will create additional strain on the department, faculty, staff, and students.

The Agricultural and Biosystems Engineering department celebrated the 100th year anniversary in 2007. During that time the department has lead the way in many endeavors that supported the profession, served the stakeholders, and contributed to the university. It is through this strategic plan that the department begins its second century of service with expectations of continued leadership. This department remains committed to the Land Grant philosophy of serving the people of Iowa, our nation, and the world through learning, discovery, and engagement, especially as human needs become more global in nature and population growth requires increased food supplies and security.

2008 NAIT Accreditation Visit

Agricultural & Biosystems Engineering Department
Iowa State University
Industrial Technology Degree Program
Agricultural Systems Technology Degree Program
Accreditation Team: Dr. Jon Duff, Dr. Kenneth W. Stier, and Mr. Mark Kelchner

Preliminary Itinerary for NAIT Accreditation Visit

Wednesday, April 16

5:00 PM		NAIT Team arrival to Iowa State University campus and the Agricultural and Biosystems Engineering Department. (Conference Room, 114 Davidson Hall)
5:10 – 5:40 PM		NAIT Accreditation Team [Dr. Jon Duff, Dr. Kenneth W. Stier, and Mr. Mark Kelchner] meeting with Dr. Ramesh Kanwar, Dr. Thomas Brumm, Dr. Joseph Chen, and Dr. Chuck Schwab (Conference Room, 114 Davidson Hall)
5:40 – 6:10 PM		Tour Davidson Hall technology teaching laboratories, classrooms, and facilities (Dr. Thomas Brumm laboratory tour guide)
	125 D & 125 E	Computer Laboratory – Contact: Mr. Alan Kuuttila
	143	Electric Laboratory – Faculty contact: Dr. Carl Bern
	147	Tractor Power Laboratory – Faculty contact: Dr. Stuart Birrell
	150	Hydraulic Laboratory – Faculty contact: Dr. Brian Steward
	142	Bio Materials Laboratory – Faculty contact: Dr. Thomas Brumm
	130	Precision Agriculture Laboratory – Faculty contact: Dr. Sunday Tim
	124	Plastics and Process Laboratory – Faculty contact: Dr. David Grewell
6:20 – 7:00 PM		NAIT Team dinner provided (Conference Room, 107 Industrial Education II)
7:00 PM – 7:30 PM		Tour Industrial Education II technology teaching laboratories, classrooms, and facilities (Dr. Thomas Brumm laboratory tour guide)
	201	Computer Laboratory – Faculty contact: Mr. Jim Shahan
	10	Robotics Laboratory – Faculty contact: Dr. Lie Tang
	40	CNC Laboratory – Faculty contact: Dr. Joseph Chen
	33	Departmental Shop – Contact: Mr. Mark Lott
7:30 PM – 8:00 PM		Last minute details or questions before heading back to hotel

Thursday, April 17

8:00 – 8:25 AM	NAIT Team conducts short interviews with selected faculty Dr. Amy Kaleita (Conference Room, 114 Davidson Hall) Dr. Carl Bern (Conference Room, 108 Davidson Hall) Dr. Lie Tang (Conference Room, 204 Davidson Hall)

8:25 – 8:50 AM	NAIT Team individuals meeting with specific Iowa State University support contacts for identified areas. Student Services – Dr. Thomas Polito, Director (Conference Room, 114 Davidson Hall [Dr. Kenneth W. Stier]) Department Chair – Dr. Ramesh Kanwar (Conference Room, 108 Davidson Hall [Dr. Jon Duff]) Computer Support – Mr. Alan Kuuttila and Dr. Raj Raman (Conference Room, 204 Davidson Hall [Mr. Mark Kelchner])
9:00 – 9:50 AM	NAIT Team [Dr. Jon Duff, Dr. Kenneth W. Stier, and Mr. Mark Kelchner] meeting with Executive Vice President and Provost Dr. Elizabeth Hoffman (1550 Beardshear Hall) escorted by Dr. Schwab (*Fixed time*)
10:00 – 10:25 AM	NAIT Team conducts short interviews with selected faculty Dr. Nir Keren (Conference Room, 114 Davidson Hall) Dr. Joseph Chen (Conference Room, 108 Davidson Hall) Mr. Jim Shahan (Conference Room, 204 Davidson Hall)
10:25 – 10:50 AM	NAIT Team individuals meeting with specific Iowa State University support contacts (Begin from Conference Room, 114 Davidson Hall) Librarian – Dr. Pali Kuruppu, Departmental Liaison (Conference Room, 114 Davidson Hall [Mr. Mark Kelchner]) Facilities –Mr. Craig Schmidt, Development Officer College of Agriculture and life Sciences (Conference Room, 108 Davidson Hall [Dr. Jon Duff]) Placement Services – Mr. Mike Gaul, Director (Conference Room, 204 Davidson Hall [Dr. Kenneth W. Stier])
11:00 – 11:50 AM	NAIT Team conducts short interviews with peer mentors and student club leaders (Conference Room, 114 Davidson Hall)
11:55 AM – 1:00 PM	NAIT Team [Dr. Jon Duff, Dr. Kenneth W. Stier, and Mr. Mark Kelchner] luncheon with chairs of departments offering support classes for Industrial Technology and Agricultural Systems Technology Majors (location in Davidson to be determined)
1:00 – 1:25PM	NAIT Team individuals meeting with specific Iowa State University support contacts for identified areas and faculty. Mr. Marc Harding, Admission Director, Mr. Phil Caffrey, Senior Associate Director, and Ms. Laura Doering, Director of Transfer Relations (Conference Room, 114 Davidson Hall [Dr. Jon Duff]) Dr. Steven Mickelson, Director of Assessment (Conference Room, 204 Davidson Hall [Dr. Kenneth W. Stier])
1: 25 – 1:50 PM	NAIT Team conducts short interviews with selected faculty Dr. David Grewell (Conference Room, 114 Davidson Hall) Ms. Melody Carroll, Academic Advisor (Conference Room, 108 Davidson Hall [Dr. Kenneth W. Stier]) Facilities – Mr. Mark Huss, Facilities Engineer, (Conference Room, 204 Davidson Hall [Mr. Mark Kelchner])

2:00 – 2:25 PM	NAIT Team Break
2: 25 – 2:50 PM	NAIT Team conducts short interviews with selected faculty Dr. Thomas Glanville (Conference Room, 114 Davidson Hall) Dr. Steven Freeman (Conference Room, 108 Davidson Hall)
3:00 – 3:50 PM	NAIT Team [Dr. Jon Duff, Dr. Kenneth W. Stier, and Mr. Mark Kelchner] meeting Dean of the College of Agriculture and Life Sciences Wendy Wintersteen, and Associate Dean for Instruction David Acker (138 Curtiss Hall) escorted by Dr. Chuck Schwab (*Fixed time*)
4:00 – 4:25 PM	NAIT Team conducts short interviews with selected faculty Dr. Matthew Darr (Conference Room, 114 Davidson Hall) Dr. Stuart Birrell (Conference Room, 108 Davidson Hall) Dr. Chuck Schwab (Conference Room, 204 Davidson Hall)
4:25 – 4:50 PM	NAIT Team conducts short interviews with selected faculty Dr. Jacek Koziel (Conference Room, 114 Davidson Hall) Dr. Raj Raman (Conference Room, 108 Davidson Hall) Dr. Brian Steward (Conference Room, 204 Davidson Hall)
5:00 – 6:00 PM	NAIT Team dinner (location in Davidson to be determined)
6:00 PM –	NAIT Team working session (Conference Room, 114 Davidson Hall)

<u>Friday, April 18</u>

8:00 – 8:25 AM	NAIT Team meeting with selected faculty and instructor Ms. Lequetia Ancar (Conference Room, 114 Davidson Hall) Dr. Sunday Tim (Conference Room, 108 Davidson Hall) Dr. Thomas Brumm (Conference Room, 204 Davidson Hall)
8:25 – 11:50 AM	NAIT Team meeting to discuss major finding and recommendation for report (Conference Room, 114 Davidson Hall) Also open time to check on TSM course being taught.
Noon – 1:15 PM	NAIT Team [Dr. Jon Duff, Dr. Kenneth W. Stier, and Mr. Mark Kelchner] luncheon with the ABE External Advisory Committee members that are available (Conference Room, 114 Davidson Hall) (*Fixed time*)
1:15 – 2:50 PM	NAIT Team final meeting to review and agree upon major finding and recommendation for final report (Conference Room, 114 Davidson Hall)
3:00 – 4:00 PM	NAIT Team [Dr. Jon Duff, Dr. Kenneth W. Stier, and Mr. Mark Kelchner] exit interview with Executive Vice President and Provost Dr. Elizabeth Hoffman, (Other Associate Provost not identified), Dr. Ramesh Kanwar, and Dr. Chuck Schwab (1550 Beardshear Hall) (*Fixed time*)
4:30 PM	NAIT Team departs for Des Moines Airport

SECTION 7.1

Program Title, Mission, and General Outcomes: *The program/option title, definition and mission shall be compatible with the NAIT definition of Industrial Technology. The program/option shall lead to a degree at the associate, bachelors, or masters level. NAIT approved definitions for degree programs are as follows:*

a. **Associate Degree:** *Programs/options that prepare individuals for positions that contribute to the design and development, production, distribution or operational support of complex technical systems.*

b. **Baccalaureate Degree:** *Programs/options that prepare individuals for positions that involve the management of complex technological systems.*

c. **Master's Degree:** *Programs/options that prepare individuals for career advancement in that involve the management of complex technological systems.*

Program Inputs:

7.1 Program Title, Mission, and General Outcomes: *The program/option title, definition and mission shall be compatible with the NAIT definition of Industrial Technology. The program/option shall lead to a degree at the associate, bachelors, or masters level. NAIT approved definitions for degree programs are as follows:*

- ***a. Associate Degree:*** *Programs/options that prepare individuals for positions that contribute to the design and development, production, distribution or operational support of complex technical systems.*
- ***b. Baccalaureate Degree:*** *Programs/options that prepare individuals for positions that involve the management of complex technological systems.*
- ***c. Master's Degree:*** *Programs/options that prepare individuals for career advancement in that involve the management of complex technological systems.*

General outcomes shall be established for each program/option that provide a framework for the development of specific measurable competencies. Validation of the general outcomes shall be accomplished through a combination of external experts, an industrial advisory committee and, after the program is in operation, follow up studies of graduates.

Only institutions legally authorized under applicable state law to provide degree programs beyond the secondary level and that are recognized by the appropriate regional and/or national accrediting agency are considered for accreditation. Evidence must exist that the programs are understood and accepted by the university/college community, and the business/industry community.

Industrial Technology Undergraduate Degree Program

Title: Industrial Technology (ITec)

Mission: The mission of the Industrial Technology program at Iowa State University is to prepare women and men for careers that integrate and apply industrial technology to lead and manage human, manufacturing, and safety systems.

Program Objectives: The ITec degree program at Iowa State University has the following educational objectives for its graduates. At two to five years after undergraduate graduation, through professional practice in industrial technology, graduates should:

1. Have demonstrated competence in methods of analysis involving use of mathematics, fundamental physical and biological sciences, technology, and computation needed for the professional practice in the field of industrial technology.
2. Have developed skills necessary to contribute to the design process; including the abilities to think creatively, to formulate problem statements, to communicate effectively, to synthesize information, and to evaluate and implement problem solutions.
3. Be capable of addressing issues of ethics, safety, professionalism, cultural diversity, globalization, environmental impact, and social and economic impact in professional practice.
4. Have demonstrated continuous professional and technical growth, with practical experience, so as to be licensed in their field or achieve that level of expertise, as applicable.
5. Have demonstrated the ability to:
   - a. be a successful leader of multi-disciplinary teams,
   - b. efficiently manage multiple simultaneous projects,
   - c. work collaboratively,
   - d. implement multi-disciplinary systems-based solutions,
   - e. to apply innovative solutions to problems through the use of new methods or technologies,

f. contribute to the business success of their employer, and
g. build community.

General Program Outcomes: Graduates of the Industrial Technology curriculum should have:

a) an ability to apply knowledge of mathematics, science, technology and applied sciences;
b) an ability to design and conduct experiments, as well as to analyze and interpret data;
c) an ability to formulate or design a system, process or program to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
d) an ability to function on multi-disciplinary teams;
e) an ability to identify and solve applied science problems;
f) an understanding of professional and ethical responsibility;
g) an ability to communicate effectively;
h) the broad education necessary to understand the impact of solutions in a global, economic, environmental, and societal context;
i) a recognition of the need for, and an ability to engage in life-long learning;
j) a knowledge of contemporary issues; and
k) an ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice.

Option Specific Program Outcomes: In addition to the general program outcomes for graduates of the Industrial Technology curriculum, these students will have option specific outcomes. The Industrial Technology graduates in the Manufacturing option should have:

l) an ability to develop, implement, and evaluate manufacturing processes and facilities;
m) an ability to apply computer aided design and manufacturing, control systems, and automation systems to industrial settings
n) an ability to implement and analyze the use of manufacturing technologies to enhance production, quality, and profitability of manufacturing systems

The Industrial Technology graduates in the Occupational Safety option should have:

l) an ability to develop, implement, and evaluate occupational safety and health programs for businesses and organizations
m) an ability to identify and analyze hazards and loss producing conditions in work environments
n) an ability to eliminate or control occupational hazards using appropriate technologies, administrative interventions, and training for behavior modification

Agricultural Systems Technology Undergraduate Degree Program

Title: Agricultural Systems Technology (AST)

Mission: The mission of the Agricultural Systems Technology (AST) program at Iowa State University is to prepare women and men for careers that integrate and apply agricultural and biosystems engineering technology to manage human and natural resource systems for producing, processing, and marketing food and other biological products worldwide.

Program Objectives: The AST degree program at Iowa State University has the following educational objectives for its graduates. At two to five years after undergraduate graduation, through the professional practice in agricultural technology, graduates should:

1. Have demonstrated competence in methods of analysis involving use of mathematics, fundamental physical and biological sciences, technology, and computation needed for the professional practice in the field of agricultural technology.
2. Have developed skills necessary to contribute to the design process; including the abilities to think creatively, to formulate problem statements, to communicate effectively, to synthesize information, and to evaluate and implement problem solutions.

3. Be capable of addressing issues of ethics, safety, professionalism, cultural diversity, globalization, environmental impact, and social and economic impact in professional practice.
4. Have demonstrated continuous professional and technical growth, with practical experience, so as to be licensed in their field or achieve that level of expertise, as applicable.
5. Have demonstrated the ability to:
   a. be a successful leader of multi-disciplinary teams,
   b. efficiently manage multiple simultaneous projects,
   c. work collaboratively,
   d. implement multi-disciplinary systems-based solutions,
   e. to apply innovative solutions to problems through the use of new methods or technologies,
   f. contribute to the business success of their employer, and
   g. build community.

General Program Outcomes: Graduates of the Agricultural Systems Technology curriculum should have:

a) an ability to apply knowledge of mathematics, science, technology, and applied sciences;
b) an ability to design and conduct experiments, as well as to analyze and interpret data;
c) an ability to formulate or design a system, process or program to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
d) an ability to function on multi-disciplinary teams;
e) an ability to identify and solve applied science problems;
f) an understanding of professional and ethical responsibility;
g) an ability to communicate effectively;
h) the broad education necessary to understand the impact of solutions in a global, economic, environmental, and societal context;
i) a recognition of the need for, and an ability to engage in life-long learning;
j) a knowledge of contemporary issues; and
k) an ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice.

Option Specific Program Outcomes: In addition to the general program outcomes for graduates of the Agricultural Systems Technology curriculum, these students will have option specific outcomes. The Agricultural Systems Technology graduates in the Machine Systems option should have:

l) an ability to specify, manage, and test machine systems in the context of complete agricultural, biological production or processing systems
m) an understanding of the technology and application of machine systems including power and information flows, function and interaction with biological materials
n) an ability to perform energy and cost analyses of complete machine systems to insure the success and sustainability of an enterprise

The Agricultural Systems Technology graduates in the Agricultural & Biosystems Management option should have:

l) an ability to develop, implement, and evaluate best management practices for human and natural resource systems for producing, processing and marketing bio-based products worldwide
m) an ability to integrate and apply agricultural and biosystems engineering technologies in the bio-based industries
n) an understanding of the complex systems that sustain our water, air, soils, and food

Validation of Outcomes

The general and option specific outcomes for both degree programs were validated by the External Advisory Council and the Agricultural and Biosystems Engineering faculty during 2007. An outcome validation instrument was given to both groups. The validation instrument requested that the recipient read each of the general outcomes for the degree programs and check the box next to the rating as to how important these are to the professional practice of Agricultural Systems Technology and Industrial Technology. It was clear in the validation instrument that there were outcomes for both degree programs and all four degree options. The rating options given were “Not Applicable,” “Unnecessary,” “Useful but not necessary,” “Important Very,” “Important,” and “Essential.” They were also instructed if they rated any general outcomes from “not applicable” to “useful but not necessary” to use the comment space and provide an explanation for that rating. They were also instruction to make comments they wish for any outcomes.

Both groups were also request to read each of the option specific outcomes and rate how important these are to the professional practice of Agricultural Systems Technology or Industrial Technology for that option. The rating options given were “Not Applicable,” “Unnecessary,” “Useful but not necessary,” “Important Very,” “Important,” and “Essential.” Again if they rated any option specific outcomes in the range from “not applicable” to “useful but not necessary” they were requested to use the comment space and provide an explanation for that rating.

A total of 17 External Advisory Council members and 31 Agricultural and Biosystems Engineering faculty participated. Results from these validation processes were tabulated by assigning the value to each rating option. The rating options were assigned the point values as indicated “Not Applicable” - 0, “Unnecessary” - 1, “Useful but not necessary” - 2 “Important Very” - 3, “Important” - 4, and “Essential” - 5. The results of the validation for the general program outcomes by External Advisory Council and ABE Faculty for Industrial Technology and Agricultural Systems Technology degree programs are presented in Table 7.1.1. No participant selected the “Not Applicable,” or “Unnecessary” response for any of the general outcomes and only one participant selected “Useful but not necessary” response in two outcomes.

There was general consensus among the External Advisory Council and ABE Faculty that the highest scoring general program outcome was “ability to apply knowledge of mathematics, science, technology and applied sciences” with a 4.47 and 4.83 for the Industrial Technology program by the External Advisory Council and ABE Faculty respectively and a 4.60 and 4.86 for the Agricultural Systems Technology program by the External Advisory Council and ABE Faculty respectively. The lowest scoring general program outcome was also a general consensus. The lowest scoring general program outcome was “a knowledge of contemporary issues” with a 3.06 and 3.65 for the Industrial Technology program by the External Advisory Council and ABE Faculty respectively and a 3.20 and 3.57 for the Agricultural Systems Technology program by the External Advisory Council and ABE Faculty respectively. The numerical scoring between the External Advisory Council and the ABE Faculty were different but general observations based on their scores were consistent.

The option specific outcomes scores ranged from a low of 3.82 to a high of 4.66 and are shown in Tables 7.1.2 and 7.1.3. There was less variation of scores in the option specific outcomes than the general outcomes. The option specific outcomes for the Occupational Safety option in the Industrial Technology program received the highest scoring by both External Advisory Council and ABE Faculty.

Institution Legally Authorized to Provide Degree Programs

Iowa State University is accredited by the Higher Learning Commission. It is a commission of the North Central Association of Colleges and Schools. (http://www.ncahigherlearningcommission.org/). Iowa State University received accreditation in March 2006. Overall observation by the Higher Learning Commission indicated that Iowa State University has made noteworthy progress in positioning itself to respond more effectively to the needs of Iowans and to increase its stature within the ranks of Land Grant universities. Next comprehensive visit is scheduled for 2015-2016.

The Iowa law was signed to establish the institution that would become Iowa State University on March 28, 1858. Scanned copy of document for ISU Archives is provided in Appendix 7.1.

Table 7.1.1 Validation of Industrial Technology and Agricultural Systems Technology General Program Outcomes by External Advisory Council and ABE Faculty

General Program Outcomes	Industrial Technology		Agricultural Systems Technology	
	External Advisory Council	ABE Faculty	External Advisory Council	ABE Faculty
(a) ability to apply knowledge of mathematics, science, technology and applied sciences;	4.47	4.83	4.60	4.86
(b) an ability to design and conduct experiments, as well as to analyze and interpret data;	3.71	4.03	3.80	4.03
(c) ability to formulate or design a system, process or program to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;	4.24	4.31	3.87	4.34
(d) ability to function on multi-disciplinary teams;	4.35	4.59	4.40	4.45
(e) ability to identify and solve applied science problems;	4.35	4.62	4.27	4.62
(f) understanding of professional and ethical responsibility;	4.47	4.62	4.47	4.62
(g) an ability to communicate effectively	4.59	4.62	4.27	4.62
(h) the broad education necessary to understand the impact of solutions in a global economic, environmental, and societal context;	3.59	3.69	3.67	3.66
(i) recognition of the need for, and an ability to engage in life-long learning;	3.65	4.03	3.67	4.03
(j) a knowledge of contemporary issues	3.06	3.65	3.20	3.57
(k) an ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice	3.94	4.45	4.27	4.45

Table 7.1.2 Validation of Industrial Technology Option Specific Program Outcomes by External Advisory Council and ABE Faculty

Option / Option Specific Outcomes	**External Advisory Council**	**ABE Faculty**
Manufacturing		
(l) an ability to develop, implement, and evaluate manufacturing processes and facilities;	4.53	4.66
(m) an ability to apply computer aided design and manufacturing, control systems, and automation systems to industrial settings	3.82	4.31
(n) an ability to implement and analyze the use of manufacturing technologies to enhance production, quality, and profitability of manufacturing systems	4.24	4.45
Occupational Safety		
(l) an ability to develop, implement, and evaluate occupational safety and health programs for businesses and organizations	4.44	4.62
(m) an ability to identify and analyze hazards and loss producing conditions in work environments	4.63	4.66
(n) an ability to eliminate or control occupational hazards using appropriate technologies, administrative interventions, and training for behavior modification	4.44	4.59

Table 7.1. 3 Validation of Agricultural Systems Technology Option Specific Program Outcomes by External Advisory Council and ABE Faculty

Option / Option Specific Outcomes	**External Advisory Council**	**ABE Faculty**
Machine Systems		
(l) an ability to specify, manage, and test machine systems in the context of complete agricultural, biological production or processing systems	4.27	4.62
(m) an understanding of the technology and application of machine systems including power and information flows, function and interaction with biological materials	4.40	4.48
(n) an ability to perform energy and cost analyses of complete machine systems to insure the success and sustainability of an enterprise	3.93	4.03
Agricultural & Biosystems Management		
(l) an ability to develop, implement, and evaluate best management practices for human and natural resource systems for producing, processing and marketing bio-based products worldwide	4.27	4.47
(m) an ability to integrate and apply agricultural and biosystems engineering technologies in the bio-based industries	4.47	4.20
(n) an understanding of the complex systems that sustain our water, air, soils, and food	4.20	4.24

SECTION 7.2

Competency Identification & Validation: *Measurable competencies shall be identified and validated for each program/option. These competencies must closely relate to the general outcomes established for the program/option and validation shall be accomplished through a combination of external experts, an industrial advisory committee and, after the program is in operation, follow up studies of program graduates.*

7.2 Competency Identification & Validation: *Measurable competencies shall be identified and validated for each program/option. These competencies must closely relate to the general outcomes established for the program/option and validation shall be accomplished through a combination of external experts, an industrial advisory committee and, after the program is in operation, follow up studies of program graduates.*

The Agricultural and Biosystems Engineering department address our General Outcomes as workplace competencies. Workplace competencies are defined as the application of knowledge, skills, attitudes and values, and behaviors in the workplace. Through engagement with more than 200 constituents representing alumni, employers, co-op/intern students, parents, ISU faculty, and partnering international faculty, the College of Engineering at Iowa State University concluded that the specified outcomes (i.e., "abilities" and "understandings") were not directly measurable. In particular, we believe that abilities can only be inferred from performance.

The "ability-based" outcomes are complex combinations of competencies. Competencies are the application of behaviors and motivations to knowledge, understanding and skill. Workplace competencies are used in many engineering and technology workplaces as a model for personal and professional development.

Developmental Dimensions International, a global provider of competency-based management tools and services (www.ddiworld.com), helped us identify and validate 14 workplace competencies (Table 7.2.1) that are necessary and sufficient to measure our General Outcomes. The definition of each competency is clear, concise and independent. Specific to each definition is a set of observable and measurable key actions (Appendix 7.2). Students develop and demonstrate the General Outcomes through competency key actions in the experiential education workplace, laboratories, capstone experiences, extra-curricular activities, portfolios, and in the classroom.

These 14 competencies are mapped to the General Outcomes (Table 7.2.2). The mapping was originally identified and validated for the similar outcomes for engineering programs at Iowa State University. In order to validate the mapping for the two technology programs, the ABE External Advisory Committee and the ABE Faculty were surveyed to rank the importance of each competency to each Outcome. The resultant score (on a scale of 1 to 5) is a weighting factor, reflecting the importance of the specific competencies in addressing the matched Outcome. All Outcomes-Competency mappings received a ranking of 3.0 (important) or higher. The only exception was the combination of General Outcome (j) and the competency "a knowledge of contemporary issues", which received an average ranking of 2.83.

A more complete description of the relationship between competencies, outcomes and assessment can be found in Appendix 7.2 in a paper entitled "*Assessing and Developing Program Outcomes Through Workplace Competencies*," published in the International Journal of Engineering Education. Also included is a paper accepted for publication in the same journal entitled "*Competency-based outcomes assessment for agricultural engineering programs.*" The model used to assess the department's agricultural engineering degree program is nearly identical to the model used to assess the two technology programs.

On-going feedback from employers shows that safety is a major concern in the engineering and technology workplace. The ABE department assesses an additional competency we call "Safety Awareness" not initially identified by our constituents. While it is not linked to our Program Outcomes, it does provide us with important information that we consider in our continuous curricular improvement process.

The ABE department has more work to do to fully validate the Outcomes and Competencies. We must validate them for each program option, as the initial validation considered both programs as a whole. We must conduct studies with program graduates to validate these competencies.

Table 7.2.1. The 14 Workplace Competencies Identified and Validated by Constituents

Competency	Definition
Analysis and Judgment	Identifying and understanding issues, problems and opportunities; developing the relevant criteria and comparing data from different sources to draw conclusions; using effective approaches for choosing courses of action or developing appropriate solutions; taking actions that are consistent with available facts, constraints, and probable consequences.
Communication	Clearly conveying information and ideas through a variety of media to individuals or groups in a manner that engages the audience and helps them understand and retain the message.
Continuous Learning	Actively identifying new areas for learning; regularly creating and taking advantage of learning opportunities; using newly gained knowledge and skill on the job, and learning through application.
Cultural Adaptability	Being open to and making changes to accommodate the differences found in other cultures in order to interact effectively with individuals and groups from different cultural backgrounds.
Customer Focus	Making customers and their needs a primary focus of one's actions; developing and sustaining productive customer relationships.
Engineering/Technical Knowledge	Having achieved a satisfactory level of knowledge in the relevant specialty areas of engineering, technology, science and mathematics.
General Knowledge	Having achieved a satisfactory level of knowledge outside the areas of engineering, science and mathematics
Initiative	Taking prompt action to accomplish objectives; taking action to achieve goals beyond what is required; being proactive.
Innovation	Generating creative, non-traditional technical solutions in work situations; trying different and novel ways to deal with work problems and opportunities.
Integrity	Maintaining social, ethical, and organization norms; firmly adhering to codes of conduct and professional ethical principles.
Planning	Effectively managing one's time and resources to ensure that work is completed efficiently.
Professional Impact	Creating a good first impression, commanding attention and respect, showing an air of confidence.
Quality Orientation	Accomplishing tasks by considering all areas involved, no matter how small; showing concern for all aspects of the job; accurately checking processes and tasks; being watchful over a period of time.
Teamwork	Effectively participating as a member of a team to move the team toward completion of goals.

Table 7.2.2. Relationship Between General Outcomes and Workplace Competencies*

Program Outcome	Competency													
	Analysis and Judgment	**Communication**	**Continuous Learning**	**Cultural Adaptability**	**Customer Focus**	**Engineering/Technical Knowledge**	**General Knowledge**	**Initiative**	**Innovation**	**Integrity**	**Planning**	**Professional Impact**	**Quality Orientation**	**Teamwork**
a) an ability to apply knowledge of mathematics, science, and applied sciences	4.43		3.91			4.48		3.78						
b) an ability to design and conduct experiments, as well as to analyze and interpret data	4.30		3.86		3.13	4.30		3.78	3.87		3.96		4.13	3.39
c) an ability to formulate or design a system, process or program to meet desired needs	4.22	3.50	3.96	3.78	4.14	4.17		4.04	4.30		4.04		4.00	3.87
d) an ability to function on multi-disciplinary teams	3.70	4.45		4.09	3.81			3.70		4.22	4.00	3.91		4.57
e) an ability to identify and solve applied science problems	4.26	3.39	3.59		3.13	4.43		3.74	3.70				3.52	3.52
f) an understanding of professional and ethical responsibility	3.91		3.43	3.70			3.64			4.39			3.61	
g) an ability to communicate effectively		4.48			4.27		3.68	4.10				3.96		
h) the broad education necessary to understand the impact of solutions in a global and societal context	3.39		4.09	4.13		3.41	4.00							
i) recognition of the need for, and an ability to engage in life-long learning			4.35					3.86						
j) a knowledge of contemporary issues	**2.83**		4.00	3.73			3.87							
k) an ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice	4.05		3.96	3.00		4.10		3.68					3.57	

* Numbers represent constituents' average rating of how essential the competency is to the outcome (5=essential, 4=very important, 3=important, 2=useful but not essential, 1=unnecessary).

SECTION 7.3

Transfer Course Work: *The institution shall have policies in place to ensure that course-work transferred to the program is evaluated and approved by program faculty. All transfer coursework accepted must meet the minimum NAIT course requirements for the degree program.*

7.3 Transfer Course Work: *The institution shall have policies in place to ensure that coursework transferred to the program is evaluated and approved by program faculty. All transfer coursework accepted must meet the minimum NAIT course requirements for the degree program.*

Transfer Student Admission

The Industrial Technology and Agricultural Systems Technology programs follow the University transfer policies which are described below. Departmental advisors or faculty cannot override these policies.

Students who seek admission must meet the following requirements and also any special requirements for the college and curriculum of their choice. Applicants must submit an application form for admission, together with the appropriate fee (see www.admissions.iastate.edu for current application fee information). Applicants must also request that each college they have attended send an official transcript of record to the Office of Admissions. Failure to provide transcripts from all colleges or universities attended may result in denial of the application or dismissal from the university. If less than 24 semester hours of graded transferable college credit is completed prior to entry at Iowa State University, applicants must also request that their official high school transcript and ACT or SAT scores be sent to the Office of Admissions. Other transfer applicants are encouraged to provide high school academic information. Students who do not do so may be asked to take course placement examinations during orientation. Applicants who have not graduated from an approved Iowa high school and whose primary language is not English should provide the results of a Test of English as a Foreign Language (TOEFL). The TOEFL may be waived if their scores on the ACT or SAT are adequate for placement in Iowa State freshman composition courses.

A. Transfer applicants with a minimum of 24 semester hours of graded transferable credit from regionally accredited colleges or universities, who have achieved for all college work previously attempted the grade point average required by Iowa State for specific programs, will be admitted. A 2.00 grade point average (on a 4.00 grading scale) is the minimum transfer grade point average requirement. Some programs may require a transfer grade point average higher than this minimum. Higher academic standards may be required of students who are not residents of Iowa, including international students. Applicants who have not maintained the grade point average required by Iowa State University for specific programs or who are under academic suspension from the last college attended generally will be denied admission.

B. In addition to meeting the minimum transfer grade point average requirement described above, applicants who have completed fewer than 24 semester hours of graded transferable college credit prior to their enrollment at Iowa State must also meet the admission requirements for students entering directly from high school.

C. Transfer applicants under disciplinary suspension will not be considered for admission until information concerning the reason for the suspension has been received from the college assigning the suspension. Applicants granted admission under these circumstances will be admitted on probation.

D. Transfer applicants from colleges and universities not regionally accredited will be considered for admission on an individual basis, taking into account all available academic information.

All transfer students must provide appropriate documentation to prove they meet the aforementioned policies. These policies are monitored at the departmental, college, and university levels. Copies of admittance documentation are maintained in the student's advising folder.

Procedures for Validating Transfer Credits

The Industrial Technology and Agricultural Systems Technology programs follow University transfer credit policies.

Credits presented from another institution are evaluated initially by the Office of Admissions to determine whether the courses are acceptable for transfer credit. In addition, credits applied toward a particular degree will be determined by the student's college, based on relevance to the students' program requirements as well as the level of performance deemed necessary for successful progress in that program. For example, courses that are deemed important to a program but were earned with less than a C grade may or may not be approved for a program. This policy also applies to students already enrolled at Iowa State University and to new transfer students. Grades earned in courses transferred to Iowa State University will not be used in calculating a transfer student's Iowa State cumulative grade point average. A student who is admitted as a transfer from another college or university is required to have at least a 2.00 cumulative grade-point average for all transferable work taken elsewhere. If, due to special circumstances, a student is admitted with less than a 2.00 average, that student has a transfer quality-point deficiency.

The Industrial Technology and Agricultural Systems Technology degree programs does not accept transfer credits for courses that were earned with a C grade or below. When a student brings in a transfer course that does not have an established ISU equivalency, the student is required to have the course syllabus and requested course material evaluated by an appropriate ISU designated course evaluator. To be accepted into the Agricultural Systems Technology and Industrial Technology programs, the transfer course must be (1) evaluated either as an ISU equivalent course http://www.admissions.iastate.edu/equiv/index.php or (2) approved by the ABE Technology Curriculum Committee as a reasonable substitution for the ISU course.

Departmental Policy for Validating Transfer Credits

If a transfer course has not already been approved and included in the university's transfer equivalency guide, then the department deals with these courses on an individual basis using the following process:

1. The student will provide a copy of the syllabus for the transferred course to the academic advisor for pre-approval and then to the chair of the ABE Technology Curriculum Committee.
2. The chair of the ABE Technology Curriculum Committee will send the syllabus to the appropriate faculty member based on the content of the course and request feedback concerning how the transfer course fits into departmental curriculum and which department course (if any) would the transfer course serve as an appropriate substitution.
3. The chair then brings the faculty recommendation to the ABE Technology Curriculum Committee for discussion and action.
4. If the appropriate faculty member and the ABE Technology Curriculum Committee considers the new transfer course to be equivalent to a departmental course, then the committee approves the use of that course for that student. If the committee deems the course to be equivalent to or a reasonable substitution for a departmental course, the committee may also decide to initiate action to have that course added to the university transfer course equivalency guide.

SECTION 7.4

Identification of Competency Measures: *Assessment measures shall exist for each of the measurable competencies identified for the program/option.*

7.4 Identification of Competency Measures: *Assessment measures shall exist for each of the measurable competencies identified for the program/option.*

Measurements in our continuous improvement process are divided into two categories: direct and indirect. Direct measures are the primary evidence of student achievement of the General Outcomes. These measures are observations and evaluations of student performance. Indirect measures (e.g., surveys, student satisfaction, placement, etc.) provide background information but are not the basis of judgment for attainment of the General Outcomes.

Direct Measures

Internship Evaluations – Supervisor Assessment

We use an on-line competency-based assessment tool for the experiential education workplace. Online Performance and Learning (OPAL™) is a competency development and performance management software created by Development Dimension International (www.ddiworld.com). It provides assessment, development, coaching and learning tools. OPAL™ was customized to present the ISU Competencies, Key Actions, and Assessment Surveys. To receive academic credit for a work term, each student is required to complete the standard self-assessment and to make sure that the supervisor completed the same assessment of the student.

The standard assessment survey consists of the 64 Key Actions associated with the 15 Competencies. Each supervisor provides an assessment of the student's demonstration of each Key Action in the workplace. Supervisors are asked to respond to this question for each of the Key Actions
"When given the opportunity, how often to you perform the Key Action?"

5 – always or almost always,
4 – often,
3 – usually,
2 – sometimes, and
1 – never or almost never

A value for student development and demonstration of each Competency is computed as the average of the supervisor's assessment of the associated Key Actions. A program average for each competency is computed by averaging all the supervisor Competency values.

Electronic Portfolios

Students upload artifacts that demonstrate achievement of one or more of the 15 Competencies into an electronic portfolio (ePortfolio) system. These artifacts can be graded papers written by students, graded examinations, graded laboratory reports, videos of presentations, design projects, or any form of evidence the student chooses that can be stored electronically. Artifacts are not restricted to formal class settings. They can include internship experiences, student club activities, service learning projects, volunteer work, or any extra-curricular experiences that help demonstrate the competencies. Students must self-assess themselves on each Competency Key Action. They attach a reflection to each Competency explaining their current state of development, how the artifacts demonstrate the Competency, and what implications their experiences have for the future.

Students begin work on their portfolios in their freshman year in TSM 110 and 111, and continue through the seminar series (TSM 201, 301 and 401). A satisfactory electronic portfolio is required of all students in order to pass TSM 401, Senior Seminar, a required course. AST Seniors first created electronic portfolios during the Fall of 2004. All technology students (ITec and AST) are now required to take all the seminar courses.

We first implemented portfolios in a proprietary database system that we developed to hold the artifacts. This system was based on Macromedia's Rich Internet Application (RIA) model using Dreamweaver, Flash, and Cold Fusion. While the system provided us with a good start, we did not have the capacity to support the software and make changes necessary to improve the system. In Spring 2008, we have moved to a university supported portfolio system. With this move, we were able to design into the system more student-centered features, e.g., the ability to create professional portfolios to share with prospective employers.

Built into the portfolio system is an external assessment component, where assessors (faculty) rank the student development of the Competencies. Our goal is to randomly designated and then assess 20% percent of the portfolios each year.

Although we have made great strides in using the ePortfolios for direct assessment, we are still in the preliminary stages of effectively using this assessment of meaningful program changes. Faculty members have assessed the portfolios two times so far, with mixed feedback. Students need to more clearly show the link between their artifacts and competencies. They also need to more guidance on how to write an effective reflection. These changes are being implemented in the new portfolio system and in the seminar courses. We are excited about the progress made so far, but realize we need more time and effort to make it a more effective tool.

Certification Exams

In the fall of 2007, 11 of our ITec seniors took the Society of Manufacturing Engineering Manufacturing Technology Certification exam [*Manufacturing Certification*]. Since fall 2002, 8 ITec seniors have taken the National Association of Industrial Technology Certification exam [*NAIT Certification*]. We have started to reimburse our students for the registration fee after if they pass either of these exams. This policy started in the fall of 2007.

General Outcomes addressed by these exam include (a) an ability to apply knowledge of mathematics, science, and applied science; (b) an ability to design and conduct experiments, as well as to analyze and interpret data; (c) an ability to design a system, component, or process to meet desired needs; (e) an ability to identify, formulate, and solve applied science problems; and (k) an ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice.

There are no certification exam(s) that broadly apply to the agricultural systems technology degree. We are examining the possibility of AST seniors taking relevant portions of the NAIT exam.

Senior Capstone Project Evaluation

All ITec and AST students are required to complete a capstone open-ended project. This capstone is a two semester, two credit each semester experience. Students are required each semester to complete written and oral presentations that are evaluated by the course instructor, peers and departmental faculty.

Graded Student Work

ABE faculty evaluates student homework and exams that address specific learning outcomes. Key assignments are to be placed in a student's ePortfolio. Assessment of the student work is used to address deficiencies in learning outcomes. Assignments from students' ePortfolios and those collected by the instructor will be available at the NAIT visit.

Indirect Measures

Internship Evaluations – Student Self-Assessment

The same assessment tool used for Internship Evaluations by supervisors is used for student self-assessment. To receive academic credit for the work term, each student is required to complete the standard self-assessment in OPAL™.

The standard assessment survey consists of the 64 Key Actions associated with the 14 ISU Competencies. Students are asked to respond to this question for each of the Key Actions:
"When given the opportunity, how often to you perform the Key Action?"

5 – always or almost always,
4 – often,
3 – usually,

2 – sometimes, and
1 – never or almost never

A value for student self-assessment of the development and demonstration of each Competency is computed as the average of the student's self-assessment of the associated Key Actions. A program average for each competency is computed by averaging all the student Competency values.

Senior Exit Surveys

ITec and AST seniors completes anonymous questionnaires at some point during the last three weeks before graduation. This indirect assessment method has been in use for both the AST program and the ITec program. These forms are periodically reviewed and revised by the Curriculum Committee. The questionnaire includes information on job interviews, job offers, and jobs accepted, as well as on curriculum and instruction. However, the only unified exit surveys were the one used during 2007 (Appendix 7.12).

A summary of the information on curriculum and instruction is reviewed by the Technology Curriculum Committee and other appropriate ABE teaching faculty. The Technology Curriculum Committee includes the results of the survey in its identification of program strengths and weaknesses.

Student Evaluation of Instruction (SEI)

A departmental course/instructor evaluation is administered to every student toward the end of every TSM course. The SEI instrument was revised in 2006 to focus on the achievement of student learning outcomes in the class (Appendix 7.4). Students are aware that evaluation results will be returned to the instructor only after course grades have been assigned. Results are reviewed by the Department Chair and the Curriculum Committee Chair, and then returned to the instructor, along with a listing of Departmental means for that semester.

Results are extensively used to improve instruction. The Department Chair discusses evaluation results with individual faculty during yearly performance evaluations. This discussion includes approaches to improving instruction and faculty performance. Individual faculty often track scores on individual questions from year to year as they make changes to improve the course and their instruction methods.

External Review

Every six years, the Agricultural and Biosystems Engineering Department at Iowa State University undergoes a comprehensive review of all departmental functions and activities. This review is conducted by the Cooperative State, Research, Education and Extension Service (CSREES), an agency of the U.S. Department of Agriculture. The 2004 CSREES departmental review was the culmination of external and internal reviews for all departmental programs for the period 1997-2003. The objectives of the 2004 CSREES review were:

- To obtain unbiased, critical, and creative evaluations and advice from internationally recognized engineers and scientists concerning the Department's current and proposed programs.
- To seek inputs on how to allocate scarce resources in the department most effectively over the next five to ten years regarding faculty positions, facilities improvement, and support staff.
- To obtain advice on how to be in the top three departments in the discipline in the nation over the next 5-10 years.

The results of the CSREES review, and in particular, the analysis and recommendations related to the department's teaching mission, are reviewed by the Technology Curriculum Committee and included in the Continuous Curricular Improvement Process. The 2004 CSREES report will be made available to NAIT reviewers at the time of their visit.

The most recent CSREES review did not include the Industrial Technology program, as it was not yet part of the ABE department. The next review in 2010 will include this program.

Post-graduate Survey

We intend to survey program graduates five years after graduation using the OPAL Competency Assessment. The results from this survey will identify the strongest and weakest workplace competencies.

Metric Goals

The following are the metric goals for the four direct assessment measures:

1. Students should attain at least an 80% achievement of each General Outcome as measured by their supervisor evaluation of workplace competencies in internships.
2. Students should attain at least an 80% achievement of each General Outcome as measured by their demonstration of workplace competencies in their portfolios.
3. Student scores in all categories on certification exams should be at or above the national average for industrial technologists.
4. All students in the senior capstone courses (TSM 415 and TSM 416) should score 80% or higher both their written and oral design presentations

SECTION 7.5

Program Structure & Course Sequencing: *Each program/option shall meet minimum foundation requirements. Programs/options may exceed maximum foundation requirements specified in each area, but appropriate justification must be provided. A specific list of courses and credit hours that are being counted toward each category shall be included in the Self Study Report.*

7.5 Program Structure & Course Sequencing: *Each program/option shall meet minimum foundation requirements. Programs/options may exceed maximum foundation requirements specified in each area, but appropriate justification must be provided. A specific list of courses and credit hours that are being counted toward each category shall be included in the Self Study Report.*

The specific lists of courses and credit hours being counted toward each NAIT foundation requirements category for the four options are provided in Tables 7.5.1 to 7.5.4. The order of presentation is Industrial Technology – Manufacturing Option (Table 7.5.1), Industrial Technology – Occupational Safety Option (Table 7.5.2), Agricultural System Technology – Machine Systems Option (Table 7.5.3) and Agricultural System Technology – Ag & Bio Systems Management Option (Table 7.5.4).

Justifications for Exceeding Maximum Foundation Requirements

Physical Sciences

All options exceed the physical sciences maximum credits set in the NAIT foundation requirements. These options have 1 credit more than the maximum NAIT foundation requirements. The one extra physical science course credit in all options above the NAIT Foundation credits is the result of including Phys 112 in the curricula. The Phys 112 course contains the fundamentals of electricity and magnetism that is the starting point needed for the TSM 363 Electric Power & Electronics for Agriculture & Industry course. The department and curriculum committee made the choice to use an existing university course to teach the fundamentals of electricity instead of adding a TSM course that would be classified as a Technical credit.

Additionally, the college of Agriculture and Life Sciences requires 6 credits of biological sciences. This is an increase of 3 credits in biological sciences beyond what were previous college requirements at the last accreditation.

Management

One option exceeds the management maximum credits set in the NAIT foundation requirements. The Ag & Bio Systems Management option has 2 credits more than the maximum NAIT foundation requirements. This option is focused heavily on management opportunities so there is more emphasis placed on the management aspect of operations and this is reflected in the increased number of required management credits. This option encompasses a broad base of general agricultural applications and offers flexibility to tailor area of specialization to best fit the students' interests and the career paths of agricultural managers. The professional positions accepted by graduating students are mostly in areas that benefit from the balance provided by the program's required management credits. These leadership roles are enhanced by this small increase in management credits.

Technical

One option is above the technical maximum credits set in the NAIT foundation requirements. The Manufacturing option is 2 technical credits more than the maximum NAIT foundation. This option has a higher level of engagement with machines and process that require an additional course work that generates the extra credit. The level of sequencing of these course also add to this overage of credits.

Table 7.5.1 ISU Requirements (Manufacturing Option) and NAIT Foundation Requirements

INDUSTRIAL TECHNOLOGY DEGREE - MANUFACTURING OPTION

NAIT Foundation Requirement	ISU Courses	ISU Credits	Required Min/Max Credits
	General Education		
General Education:	Engl 150 Critical Thinking and Communication	3	
Humanities,	Engl 250 Written, Oral, Visual, and Electronic Composition	3	
English,	*Business Writing Course* (select one of the 3 credit courses)	3	
History,	Engl 302 Business Communication		
Economics,	Engl 309 Report and Proposal Writing		
Sociology,	Engl 314Technical Communication		
Psychology,	*Public Speaking Course* (select one of the 3 credit courses)	3	
Speech,	SpCm 212 Fundamentals of Public Speaking		
etc.	AgEdS 311 Presentation and Sales Strategies for Agricultural Audiences		
	Lib 160 Library Instruction	0.5	
	Econ 101 Principles of Microeconomics	3	
	Ethics Course (College of Agriculture and Life Sciences List)	3	
	U.S. Diversity (University List)	3	
	Humanities (College of Agriculture and Life Sciences List)	3	
	TSM 270 Principles of Injury Prevention	3	
	General Education Totals	**27.5**	**18-36**
	Mathematics		
Mathematics	Math 142 Trigonometry and Analytic Geometry	3	
Algebra,	Math 160 Survey of Calculus	4	
Trigonometry,	Stat 104 Introduction to Statistics	3	
Analytical Geometry,	TSM 115 Solving Technology Problems	3	
Calculus, Statistics,			
Computer Science,			
etc.			
	Mathematics Totals	**13**	**6-18**
	Physical Science		
Physical Science	Phys 111 General Physics	4	
Physics,	Phys 112 General Physics	4	
Chemistry,	Chem 163 General Chemistry	4	
etc.	Chem 163L Laboratory in General Chemistry	1	
	Life Sciences (6 credits)	6	
	Biol 101 Introduction to Biology (5 credits)		
	Biol 211 Principles of Biology(3 credits)		
	Biol 173 Environmental Biology (3 credits)		
	NREM 120 Introduction to Renewable Resources (3 credits)		
	BBMB 221 Structure and Reactions in Biochemical Processes (3 credits)		
	Physical Science Totals	**19**	**6-18**

Table 7.5.1 Continued

INDUSTRIAL TECHNOLOGY DEGREE - MANUFACTURING OPTION

NAIT Foundation Requirement	ISU Courses	ISU Credits	Required Min/Max Credits
Management			
Management Quality Control, Production Planning and Control, Industrial Supervision, Industrial Finance and Accounting, Industrial Safety Management, Facilities Layout and Materials Handling, Time and Motion Study, Industrial Communications, Business Law, Marketing, etc.	TSM 110 Introduction to Technology TSM 111 Experiencing Technology TSM 201 Entrepreneurship and Internship Seminar Acct 284 Financial Accounting TSM 301 Leadership and Ethics Seminar TSM 310 Total Quality Improvement TSM 397 Internship in Technology TSM 399 Work Experience in Technology *Economics/Management* (select one 3 credit course) Econ 330 Farm Business Management Econ 336 Agricultural Selling Econ 355 International Trade and Finance Mgmt 370 Management of Organizations Mgmt 414 International Management TSM 401 Professionalism Seminar TSM 415 Technology Capstone I TSM 416 Technology Capstone II TSM 444 Facility Planning	1 1 1 3 1 3 R* 2 3 1 2 2 3	
Management Totals		**23**	**12-24**
Technical			
Technical Computer Integrated Manufacturing, Computer Aided Design, Electronics, Materials Testing, Computer Technology Packaging, Construction, Manufacturing Processes, etc.	TSM 116 Introduction to Design in Technology TSM 210 Fundamentals of Technology TSM 216 Advanced Technical Graphics, Interpretation, and CAD TSM 240 Introduction to Manufacturing Processes TSM 337 Fluid Power Systems Technology TSM 340 Advanced Automated Manufacturing Processes TSM 363 Electric Power & Electronics for Agriculture & Industry TSM 370 Occupational Safety TSM 440 Cellular Lean Manufacturing Systems TSM 443 Statics and Strength of Materials for Technology TSM 445 Polymer and Composite Processing TSM 465 Automation Systems	3 3 3 3 3 3 4 3 3 3 3 3	
Technical Totals		**37**	**24-36**
Electives			
Electives	Technical Electives (From Department approved list) *International Perspectives* (University List)	3 3	
Electives Totals		**6**	**6-18**
Degree Option Total		**125.5**	**120**

Table 7.5.2 ISU Requirements (Occupational Safety Option) and NAIT Foundation Requirements

INDUSTRIAL TECHNOLOGY DEGREE - OCCUPATIONAL SAFETY OPTION

NAIT Foundation Requirement	ISU Courses	ISU Credits	Required Min/Max Credits
	General Education		
General Education: Humanities, English, History, Economics, Sociology, Psychology, Speech, etc.	Engl 150 Critical Thinking and Communication	3	
	Engl 250 Written, Oral, Visual, and Electronic Composition	3	
	Business Writing Course (select one of the 3 credit courses) Engl 302 Business Communication Engl 309 Report and Proposal Writing Engl 314Technical Communication	3	
	Public Speaking Course (select one of the 3 credit courses) SpCm 212 Fundamentals of Public Speaking AgEdS 311 Presentation and Sales Strategies for Agricultural Audiences	3	
	Lib 160 Library Instruction	0.5	
	Econ 101 Principles of Microeconomics	3	
	Ethics Course (College of Agriculture and Life Sciences List)	3	
	U.S. Diversity (University List)	3	
	Humanities (College of Agriculture and Life Sciences List)	3	
	TSM 270 Principles of Injury Prevention	3	
	General Education Totals	**27.5**	**18-36**
	Mathematics		
Mathematics Algebra, Trigonometry, Analytical Geometry, Calculus, Statistics, Computer Science, etc.	Math 142 Trigonometry and Analytic Geometry	3	
	Math 160 Survey of Calculus	4	
	Stat 104 Introduction to Statistics	3	
	TSM 115 Solving Technology Problems	3	
	Mathematics Totals	**13**	**6-18**
	Physical Science		
Physical Science Physics, Chemistry, etc.	Phys 111 General Physics	4	
	Phys 112 General Physics	4	
	Chem 163 General Chemistry	4	
	Chem 163L Laboratory in General Chemistry	1	
	Biol 155 Human Biology	3	
	Life Sciences (3 credits) Biol 101 Introduction to Biology (5 credits) Biol 211 Principles of Biology(3 credits) Biol 173 Environmental Biology (3 credits) NREM 120 Introduction to Renewable Resources (3 credits) BBMB 221 Structure and Reactions in Biochemical Processes (3 credits)	3	
	Physical Science Totals	**19**	**6-18**

Table 7.5.2 Continued

INDUSTRIAL TECHNOLOGY DEGREE - OCCUPATIONAL SAFETY OPTION

NAIT Foundation Requirement	ISU Courses	ISU Credits	Required Min/Max Credits
	Management		
Management Quality Control, Production Planning and Control, Industrial Supervision, Industrial Finance and Accounting, Industrial Safety Management, Facilities Layout and Materials Handling, Time and Motion Study, Industrial Communications, Business Law, Marketing, etc.	TSM 110 Introduction to Technology TSM 111 Experiencing Technology TSM 201 Entrepreneurship and Internship Seminar TSM 272 Introduction to Occupational Safety Acct 284 Financial Accounting TSM 301 Leadership and Ethics Seminar TSM 310 Total Quality Improvement TSM 372 Legal Aspects of Occupational Safety and Health TSM 397 Internship in Technology TSM 399 Work Experience in Technology *Economics/Management* (select one 3 credit course) Econ 330 Farm Business Management Econ 336 Agricultural Selling Econ 355 International Trade and Finance Mgmt 370 Management of Organizations Mgmt 414 International Management TSM 401 Professionalism Seminar TSM 415 Technology Capstone I TSM 416 Technology Capstone II	1 1 1 2 3 1 3 2 R* 2 3 1 2 2	
	Management Totals	**24**	**12-24**
	Technical		
Technical Computer Integrated Manufacturing, Computer Aided Design, Electronics, Materials Testing, Computer Technology Packaging, Construction, Manufacturing Processes, etc.	H S 105 First Aid and Emergency Care TSM 116 Introduction to Design in Technology TSM 210 Fundamentals of Technology TSM 240 Introduction to Manufacturing Processes I E 271 Applied Ergonomics and Work Design TSM 276 Fire Protection and Prevention TSM 363 Electric Power & Electronics for Agriculture & Industry TSM 370 Occupational Safety TSM 470 Industrial Hygiene: Physical, Chemical, and Biological Hazards TSM 471 Safety Laboratory TSM 477 System Safety Analysis	2 3 3 3 3 3 4 3 3 1 3	
	Technical Totals	**31**	**24-36**
	Electives		
Electives	Technical Electives (From Department approved list) *International Perspectives* (University List)	5 3	
	Electives Totals	**8**	**6-18**
Degree Option Total		**125.5**	**120**

Table 7.5.3 ISU Requirements (Machine Systems Option) and NAIT Foundation Requirements

AG SYSTEMS TECHNOLOGY DEGREE – MACHINE SYSTEMS OPTION

NAIT Foundation Requirement	ISU Courses	ISU Credits	Required Min/Max Credits
	General Education		
General Education:	Engl 150 Critical Thinking and Communication	3	
Humanities,	Engl 250 Written, Oral, Visual, and Electronic Composition	3	
English,	*Business Writing Course* (select one of the 3 credit courses)	3	
History,	Engl 302 Business Communication		
Economics,	Engl 309 Report and Proposal Writing		
Sociology,	Engl 314Technical Communication		
Psychology,	*Public Speaking Course* (select one of the 3 credit courses)	3	
Speech,	SpCm 212 Fundamentals of Public Speaking		
etc.	AgEdS 311 Presentation and Sales Strategies for Agricultural Audiences		
	Lib 160 Library Instruction	0.5	
	Econ 101 Principles of Microeconomics	3	
	Ethics Course (College of Agriculture and Life Sciences List)	3	
	U.S. Diversity (University List)	3	
	Humanities (College of Agriculture and Life Sciences List)	3	
	TSM 270 Principles of Injury Prevention	3	
	General Education Totals	**27.5**	**18-36**
	Mathematics		
Mathematics	Math 142 Trigonometry and Analytic Geometry	3	
Algebra,	Math 160 Survey of Calculus	4	
Trigonometry,	Stat 104 Introduction to Statistics	3	
Analytical Geometry,	TSM 115 Solving Technology Problems	3	
Calculus, Statistics,			
Computer Science,			
etc.			
	Mathematics Totals	**13**	**6-18**
	Physical Science		
Physical Science	Phys 111 General Physics	4	
Physics,	Phys 112 General Physics	4	
Chemistry,	Chem 163 General Chemistry	4	
etc.	Chem 163L Laboratory in General Chemistry	1	
	Life Sciences (6 credits)	6	
	Biol 101 Introduction to Biology (5 credits)		
	Biol 211 Principles of Biology(3 credits)		
	Biol 173 Environmental Biology (3 credits)		
	NREM 120 Introduction to Renewable Resources (3 credits)		
	BBMB 221 Structure and Reactions in Biochemical Processes (3 credits)		
	Physical Science Totals	**19**	**6-18**

Table 7.5.3 Continued

AG SYSTEMS TECHNOLOGY DEGREE – MACHINE SYSTEMS OPTION

NAIT Foundation Requirement	ISU Courses	ISU Credits	Required Min/Max Credits
Management			
Management	TSM 110 Introduction to Technology	1	
Quality Control,	TSM 111 Experiencing Technology	1	
Production Planning and	TSM 201 Entrepreneurship and Internship Seminar	1	
Control,	Acct 284 Financial Accounting	3	
Industrial Supervision,	TSM 301 Leadership and Ethics Seminar	1	
Industrial Finance and	TSM 310 Total Quality Improvement	3	
Accounting,	TSM 330 Agricultural Machinery and Power Management	3	
Industrial Safety	TSM 397 Internship in Technology	R*	
Management,	TSM 399 Work Experience in Technology	2	
Facilities Layout and	*Economics/Management* (select one 3 credit course)	3	
Materials Handling,	Econ 330 Farm Business Management		
Time and Motion Study,	Econ 336 Agricultural Selling		
Industrial	Econ 355 International Trade and Finance		
Communications,	Mgmt 370 Management of Organizations		
Business Law,	Mgmt 414 International Management		
Marketing,	TSM 401 Professionalism Seminar	1	
etc.	TSM 415 Technology Capstone I	2	
	TSM 416 Technology Capstone II	2	
Management Totals		**23**	**12-24**
Technical			
Technical	TSM 116 Introduction to Design in Technology	3	
Computer Integrated	TSM 210 Fundamentals of Technology	3	
Manufacturing, Computer Aided Design,	TSM 216 Advanced Technical Graphics, Interpretation, and CAD	3	
Electronics, Materials	TSM 240 Introduction to Manufacturing Processes	3	
Testing, Computer	TSM 333 Precision Farming Systems	3	
Technology Packaging,	TSM 335 Tractor Power	4	
Construction,	TSM 337 Fluid Power Systems Technology	3	
Manufacturing Processes, etc.	TSM 363 Electric Power & Electronics for Agriculture & Industry	4	
	TSM 370 Occupational Safety	3	
	TSM 443 Statics and Strength of Materials for Technology	3	
	TSM 465 Automation Systems	3	
Technical Totals		**35**	**24-36**
Electives			
Electives	Technical Electives (From Department approved list)	5	
	International Perspectives (University List)	3	
Electives Totals		**8**	**6-18**
Degree Option Total		**125.5**	**120**

Table 7.5.4 ISU Requirements (Ag & Bio Systems Management Option) and NAIT Foundation Requirements

AGRICULTURAL SYSTEMS TECHNOLOGY DEGREE – AG & BIO SYSTEMS MANAGEMENT OPTION

NAIT Foundation Requirement	ISU Courses	ISU Credits	Required Min/Max Credits
	General Education		
General Education:	Engl 150 Critical Thinking and Communication	3	
Humanities,	Engl 250 Written, Oral, Visual, and Electronic Composition	3	
English,	*Business Writing Course* (select one of the 3 credit courses)	3	
History,	Engl 302 Business Communication		
Economics,	Engl 309 Report and Proposal Writing		
Sociology,	Engl 314Technical Communication		
Psychology,	*Public Speaking Course* (select one of the 3 credit courses)	3	
Speech,	SpCm 212 Fundamentals of Public Speaking		
etc.	AgEdS 311 Presentation and Sales Strategies for Agricultural Audiences		
	Lib 160 Library Instruction	0.5	
	Econ 101 Principles of Microeconomics	3	
	Ethics Course (College of Agriculture and Life Sciences List)	3	
	U.S. Diversity (University List)	3	
	Humanities (College of Agriculture and Life Sciences List)	3	
	TSM 270 Principles of Injury Prevention	3	
	General Education Totals	**27.5**	**18-36**
	Mathematics		
Mathematics	Math 142 Trigonometry and Analytic Geometry	3	
Algebra,	Math 160 Survey of Calculus	4	
Trigonometry,	Stat 104 Introduction to Statistics	3	
Analytical Geometry,	TSM 115 Solving Technology Problems	3	
Calculus, Statistics,			
Computer Science,			
etc.			
	Mathematics Totals	**13**	**6-18**
	Physical Science		
Physical Science	Phys 111 General Physics	4	
Physics,	Phys 112 General Physics	4	
Chemistry,	Chem 163 General Chemistry	4	
etc.	Chem 163L Laboratory in General Chemistry	1	
	Life Sciences (6 credits)	6	
	Biol 101 Introduction to Biology (5 credits)		
	Biol 211 Principles of Biology(3 credits)		
	Biol 173 Environmental Biology (3 credits)		
	NREM 120 Introduction to Renewable Resources (3 credits)		
	BBMB 221 Structure and Reactions in Biochemical Processes (3 credits)		
	Physical Science Totals	**19**	**6-18**

Table 7.5.4 Continued

AGRICULTURAL SYSTEMS TECHNOLOGY DEGREE – AG & BIO SYSTEMS MANAGEMENT OPTION

NAIT Foundation Requirement	ISU Courses	ISU Credits	Required Min/Max Credits
	Management		
Management	TSM 110 Introduction to Technology	1	
Quality Control,	TSM 111 Experiencing Technology	1	
Production Planning and	TSM 201 Entrepreneurship and Internship Seminar	1	
Control,	Acct 284 Financial Accounting	3	
Industrial Supervision,	TSM 301 Leadership and Ethics Seminar	1	
Industrial Finance and	TSM 310 Total Quality Improvement	3	
Accounting,	TSM 324 Soil and Water Conservation Management	3	
Industrial Safety	TSM 330 Agricultural Machinery and Power Management	3	
Management,	TSM 397 Internship in Technology	R*	
Facilities Layout and	TSM 399 Work Experience in Technology	2	
Materials Handling,	*Economics/Management* (select one 3 credit course)	3	
Time and Motion Study,	Econ 330 Farm Business Management		
Industrial	Econ 336 Agricultural Selling		
Communications,	Econ 355 International Trade and Finance		
Business Law,	Mgmt 370 Management of Organizations		
Marketing,	Mgmt 414 International Management		
etc.	TSM 401 Professionalism Seminar	1	
	TSM 415 Technology Capstone I	2	
	TSM 416 Technology Capstone II	2	
	Management Totals	**26**	**12-24**
	Technical		
Technical	TSM 116 Introduction to Design in Technology	3	
Computer Integrated	TSM 210 Fundamentals of Technology	3	
Manufacturing,	TSM 322 Preservation of Grain Quality	3	
Computer Aided Design,	TSM 327 Animal Production Systems	3	
Electronics, Materials	TSM 333 Precision Farming Systems	3	
Testing, Computer	TSM 363 Electric Power & Electronics for Agriculture &		
Technology Packaging,	Industry	4	
Construction,	TSM 424 Impacts of Agriculture on Water Quality	3	
Manufacturing	TSM 426 Technology Applications in Bio-processing	3	
Processes, etc.			
	Technical Totals	**25**	**24-36**
	Electives		
Electives	Technical Electives (From Department approved list)	12	
	International Perspectives (University List)	3	
	Electives Totals	**15**	**6-18**
Degree Option Total		**125.5**	**120**

Appropriate and a Reasonable Balance of Laboratory Activities

The majority of Technology Systems Management courses integrate a laboratory experience with the lecture. A total of 21 TSM courses have laboratory credits. Table 7.5.5 Division of Lecture and Laboratory Time in Technology Systems Management Courses list the number of credits of lecture and laboratory for each course offered in the ABE department. Each lecture hour is equal to one course credit. Two or three laboratory hours are equal to one course credit. The variation of 2 to 3 hours of laboratory time equaling one credit is based on the amount of setup time needed for various laboratory experiences.

Table. 7.5.5 Division of Lecture and Laboratory Time in Technology Systems Management Courses.

Course Number	Course Title	Lecture Credits	Lab Credits
TSM 110	Introduction to Technology	1	0
TSM 111	Experiencing Technology	0	1
TSM 115	Solving Technology Problems	2	1
TSM 116	Introduction to Design in Technology	2	1
TSM 201	Entrepreneurship and Internship Seminar	1	0
TSM 210	Fundamentals of Technology	3	0
TSM 216	Advanced Technical Graphics, Interpretation, and CAD	2	1
TSM 240	Introduction to Manufacturing Processes	1	2
TSM 270	Principles of Injury Prevention	3	0
TSM 272	Introduction to Occupational Safety	2	0
TSM 276	Fire Protection and Prevention	3	0
TSM 301	Leadership and Ethics Seminar	1	0
TSM 310	Total Quality Improvement	3	0
TSM 322	Preservation of Grain Quality	2	1
TSM 324	Soil and Water Conservation Management	2	1
TSM 327	Animal Production Systems	3	0
TSM 330	Agricultural Machinery and Power Management	2	1
TSM 333	Precision Farming Systems	2	1
TSM 335	Tractor Power	3	1
TSM 337	Fluid Power Systems Technology	2	1
TSM 340	Advanced Automated Manufacturing Processes	2	1
TSM 363	Electric Power & Electronics for Agriculture & Industry	3	1
TSM 370	Occupational Safety	3	0
TSM 372	Legal Aspects of Occupational Safety and Health	2	0
TSM 397	Internship in Technology	na	na
TSM 399	Work Experience in Technology	na	na
TSM 401	Professionalism Seminar	1	0
TSM 415	Technology Capstone I	1	1
TSM 416	Technology Capstone II	1	1
TSM 424	Impacts of Agriculture on Water Quality	3	0
TSM 426	Technology Applications in Bio-processing	2	1
TSM 433	Precision Farming Systems Advanced Concepts and Applications	3	0
TSM 440	Cellular Lean Manufacturing Systems	2	1
TSM 443	Statics and Strength of Materials for Technology	2	1
TSM 444	Facility Planning	3	0
TSM 445	Polymer and Composite Processing	2	1
TSM 465	Automation Systems	2	1
TSM 470	Industrial Hygiene: Physical, Chemical, and Biological Hazards	3	0
TSM 471	Safety Laboratory	0	1
TSM 477	System Safety Analysis	3	0

The laboratory experience is a critical component of all four options. The total number of hours of lecture and laboratory for each option and the percent of the total time spent in laboratories is listed in Table7.5.5 Amount of Lecture and Laboratory Time by Options.

Table. 7.5.6 Amount of Lecture and Laboratory Time by Options.

DEGREE/OPTION	Total Hrs. Lecture	Total Hrs. Lab	% of Total Time in Labs
Industrial Technology			
/Manufacturing option	104	41	28
/Occupational Safety option	111	31	22
Agricultural Systems Technology			
/Machine Systems option	104	43	29
/Agricultural & Biosystems Management option	108	36	25

Appropriate Sequencing of Courses
In the Iowa State University course numbering system, 100 series courses are primarily for freshmen, 200 series courses for sophomores, 300 series courses for juniors, and 400 series courses for seniors. Advisement and course prerequisites assure proper course sequencing. The 2007-2009 Iowa State University Catalog (p. 348-351) contains a description of each course and also lists the prerequisites for each course.

Applications of Mathematics and Science in Technical and Management Courses
Applications of the principles of mathematics and science are incorporated into many of the required and elective General Education and Professional courses in the Industrial Technology and Agricultural Systems Technology programs. With only a few exceptions, virtually all of the Technical Core courses incorporate applications of principles of mathematics and science. Individual course syllabi may be found in Appendix 7.5. The syllabi provide more information about the applications of mathematics and science in each of the courses.

Examples:

1. TSM 116 - *Introduction to Design in Technology* and TSM 216, *Advanced Technical Graphics*, Interpretation, and CAD, require the use mathematical skills in geometry and trigonometry to construct two and three-dimensional files.
2. TSM 210 - *Fundamentals of Technology*, problem solving requires solving both single and simultaneous algebraic equations for situations involving energy, power, simple machines, psychrometrics, ventilation, electricity and the time value of money. Unit conversions and a solid understanding of significant figures are necessary.
3. TSM 240 - *Introduction to Manufacturing Processes* uses both science and mathematics extensively. The course covers the chemical and physical properties of materials used in manufacturing.
4. The uses and interpretations of safety statistics are introduced in TSM 270, *Principles of Injury Prevention*. Students learn to calculate injury and death rates. Discussions of many of the safety topics, from fire prevention to ergonomics, have a scientific basis.
5. TSM 322 - *Preservation of Grain Quality*, problem solving requires solving both single and simultaneous algebraic equations for psychrometrics, drying, and material and energy balances. Some application of trigonometry is required to design grain equipment layout and understand equipment design based on material angle of repose. Unit conversions are frequently used.

6. TSM 324 - *Soil and Water Conservation Management*, introduces students to mathematical models to describe the movement of soil and water across agricultural landscapes. Most of these models are simple in structure, and yet describe the fundamental scientific relationships with enough accuracy to allow for assessment of the impact of management practices.
7. TSM 330 - *Agricultural Machinery and Power Management*, builds on the foundation provided by the core business courses to provide students the ability to make complete economic and cost analyses of agricultural machinery systems. The more specialized courses including TSM 335 (Tractor Power) and TSM 337 (Fluid Power Systems), to provide a broader understanding of the technologies and operations of machinery systems utilized in agricultural production systems and complements TSM 333 (Precision Farming Systems).
8. Basic science and mathematics are used by students in TSM 340, *Advanced Automated Manufacturing Processes*, to optimize machining operation based on material properties and the calculations of cutting forces and energy consumptions.
9. TSM 363 - *Electric Power & Electronics for Agriculture & Industry* requires the use of algebra, trigonometry, and calculus for calculations done in circuit analysis problems. Whether analyzing DC or AC circuits, mathematics and scientific concepts are an integral part of each student's experience. This course also requires the use of concepts from Boolean algebra and binary, octal, decimal and hexadecimal number systems.
10. Students in TSM 370, *Occupational Safety*, use both mathematics and science to evaluate workplace hazards and test mitigation strategies.
11. TSM 443 - *Statics and Strength of Materials for Technology*, calculates many problems in statics and strength of materials. Also, many concepts from physics are incorporated into vector analysis.
12. Both Science and mathematics are used by students in TSM 444, *Facility Planning*, to calculate takt time, process time, cost information for product and facility, personal allowance, time study for standard time, numbers of operators and machines to optimize the facility design, etc.
13. TSM 445 - *Polymer and Composite Processing*, requires the use of mathematics in such tasks as calculating a plastics charge for a process. Extensive application of chemical understanding is required in all phases of work with plastics and composites.
14. TSM 470 - *Industrial Hygiene* is based on the appropriate sciences. Specifically, the course includes units related to radiation, heat stress, ergonomics, noise, and ventilation.

Sequencing Should Ensure That Advanced Level Courses Build Upon Concepts
The TSM advanced level courses build upon concepts covered in beginning level TSM courses and other program courses.
Examples:

1. TSM 216 - *Advanced Technical Graphics*, *Interpretation*, and CAD provides more depth in areas of design and documentation, which were introduced in TSM 116, *Introduction to Design in Technology*. As well as introduces new concepts related to Technical Graphics. New CAD techniques and commands are also included.
2. TSM 335 - *Tractor Power*, builds on the foundation provided by TSM 210 (*Fundamentals in Technology*) to expand on the students understanding and knowledge of engine technology, mechanical power transmission and traction. In conjunction with TSM 330 (*Agricultural Machinery and Power Management*), TSM 333 (*Precision Farming Systems*) and TSM 337 (*Fluid Power Systems*) students are provided with a broad and in depth understanding of important technologies involved in modern machinery systems within the agricultural, construction and off-road industry.

3. TSM 337 - *Fluid Power Technology*, builds upon students' understanding of the fundamentals of technology and ability to solve problems, taught in TSM 210, *Fundamentals of Technology*, and TSM 115, *Solving Technology Problems*, in order to analyze fluid power systems used in technology applications.
4. TSM 340 - *Advanced Automated Manufacturing Processes*, builds on knowledge of 2D and 3D design modeling and productivity tools for manufacturing taught in TSM 216 *Advanced Technical Graphics, Interpretation, and CAD*, and the knowledge of material selection and manufacturing processes taught in TSM 240 *Introduction to Manufacturing Processes* to develop NC programming operations for advanced CNC machines, and transfer parts descriptions into detailed process plans, tool selection, and NC codes using CAD/CAM software.
5. TSM 370 - *Occupational Safety* builds upon students' understanding of safety and injury prevention techniques taught in TSM 270 - *Principles of Injury Prevention* and the safety management principles taught in TSM 272 - *Introduction to Occupational Safety* in order to eliminate or control hazards found in industrial work environments.
6. TSM 372 - *Legal Aspects of Occupational Safety and Health* builds upon students' understanding of safety management principles taught in TSM 272 - *Introduction to Occupational Safety* in order to fully understand the legal responsibilities of safety professionals and to develop safety programs that comply with the legal requirements of OSHA, EPA, and DOT regulations.
7. TSM 415 - *Technology Capstone I* and TSM 416 *Technology Capstone II* brings together the experiences of the all the course work and demonstrates those skills via a team project.
8. TSM 440 - *Cellular Lean Manufacturing Systems*, builds upon students' understanding of quality aspects in manufacturing, taught in TSM 310 *Total Quality Management*, and the CNC aspects of machining, taught in TSM 340 *Advanced Automated Manufacturing Processes*, in order to design one piece flow in cellular manufacturing systems with lean implementation for eliminating wastes.
9. TSM 444 - *Facility planning*, build on the knowledge learned from CAD design in TSM 216 *Advanced Technical Graphics, Interpretation, and CAD* to design a manufacturing related facility in a 2D setting, and from manufacturing materials and processes learned from TSM 240 *Introduction to Manufacturing Processes* in order to develop a facility with the purpose of its optimization. Stat. 101 or 104 is pre-required for TSM 444 for students to use statistical analysis for better time standard results.
10. TSM 465 - *Automation Systems*, is built upon students' fundamental knowledge about electricity, wiring, controls, digital logic circuit and commonly used industrial sensors, taught in TSM 363 *Electric Power and Electronics for Agriculture and Industry*, to equip students with knowledge and system development skills in industrial automation.
11. TSM 470 - *Industrial Hygiene: Physical, Chemical, and Biological Hazards*, utilizes principles of occupational safety, thought in TSM 272 *Introduction to Occupational Safety*, and TSM 370, *Occupational Safety*. It also includes knowledge gained in CHEM 163, 163L to assess adverse health effects due to exposure to physical, chemical, and biological hazards.
12. TSM 477 - *System Safety Analysis*, takes a risk-based approach to safety analysis of complex systems, their interaction with human and with the environment that utilizes a variety of statistical and mathematical tools; thus, background courses such as Math 160, and State 101 or State 104 is appropriate. In addition, comprehensive knowledge on adverse health effects of physical, Chemical, and biological hazards as provided in TSM 470 *Industrial Hygiene: Physical, Chemical, and Biological Hazards* is essential.

The course sequence of required courses TSM 110 - *Introduction to Technology*, TSM 111 - *Experiencing Technology*, TSM 201 - *Entrepreneurship and Internship Seminar*, TSM 301 - *Leadership and Ethics Seminar*, and TSM 401 - *Professionalism Seminar* addresses students' personal and professional development across the breadth of their academic experience. We recognize that the skills, behaviors and attitudes (competencies) necessary for academic and professional success are not part of the learning outcomes of most of the courses students take. In all these courses, we focus on competency development and demonstration. Individual courses include content relevant to the degree of a student's academic progress.

- The freshman courses focus on transitioning from high school to college. They learn skills and strategies necessary for success at the college level, are introduced to competencies, and have hands-on experiences with different technology topics to help them decide that the two technology majors are appropriate for them.
- The sophomore course takes the next step, preparing students for their (often) first professional experience in an internship. Additionally, they are exposed to the concepts of entrepreneurship, reinforcing our belief that all students need entrepreneurial skills in their careers whether they start a business or not. Entrepreneurial skills will help them self-manage their academic and professional careers. Competency development and demonstration is a major focus.
- The junior seminar further prepares students for professional practice. Concepts of leadership and ethics are explored and emphasized. Competency development and demonstration is a major focus, especially as they relate to the course topics.
- The senior seminar prepares students for the transition to professional life. Topics of importance not addressed in other classes are addressed. In this class, students must document their achievement of the competencies in order to receive a passing grade.

Another important reason for this course sequence is to assist students in preparing their portfolios. Portfolios are an important part of our continuous curriculum improvement process. Providing little or no guidance over the course of students' academic careers will result in the poor and inadequate portfolios in their senior years. Throughout their (typically) four years, students work and reflect on competency development and build their portfolios.

SECTION 7.6

Student Admission & Retention Standards: *There shall be evidence showing that the quality of Industrial Technology students is comparable to the quality of students enrolled in other majors at the institution. The standards for admission and retention of Industrial Technology students shall compare favorably with institutional standards. Sources of admission information may include test scores and grade rankings. Sources of retention information may include general grade point averages of Industrial Technology students compared to majors in other institutional programs.*

7.6 Student Admission & Retention Standards: *There shall be evidence showing that the quality of Industrial Technology students is comparable to the quality of students enrolled in other majors at the institution. The standards for admission and retention of Industrial Technology students shall compare favorably with institutional standards. Sources of admission information may include test scores and grade rankings. Sources of retention information may include general grade point averages of Industrial Technology students compared to majors in other institutional programs.*

Student Admission Standards

Iowa State University, the Agricultural Systems Technology program and Industrial Technology program welcome applications for admission from qualified men and women regardless of race, creed, color, national origin, age, or disability. The University seeks highly motivated candidates whose academic achievements and personal commitments indicate success in an undergraduate academic program.

Applicants must submit an application for admission and the appropriate application fee. In addition applicants must have their secondary school provide an official transcript of their academic record, including credits and grades, rank in class, and certification of graduation.

Applicants must also arrange to have their scores from either the ACT Assessment (ACT) or the Scholastic Assessment Test (SAT) reported to Iowa State directly from the testing agency. U.S. citizen and immigrant applicants who will not graduate from an approved Iowa high school and whose primary language is not English must meet university communication proficiency requirements. This can be accomplished by achieving satisfactory scores on the Test of English as a Foreign Language (TOEFL), the International English Language Testing System (IELTS), the ACT or SAT. Contact the Office of Admissions for minimum score requirements for each examination.

Applicants may be required to submit additional information or data to support their applications.

Graduates of approved Iowa high schools who have the subject-matter background required by Iowa State University and who rank in the upper half of their graduating class will be admitted. Students who do not rank in the upper half of their graduating class may be considered for admission to the university on an individual basis if they achieve the following combination of high school rank and ACT or SAT scores:

High School Rank (99% is high)	ACT Composite Score	SAT Combined Score
49-47%	20	930
46-45%	21	970
44-42%	22	1010
41-39%	23	1050
38% or below	24	1090

Those who do not meet these requirements but who have a high school rank of 20% or above may be given the opportunity to enroll for a trial period during a preceding summer session to establish their qualifications for fall admission. Those who have a high school rank below 20% (and an ACT below 24) will be denied admission.

Nonresidents of Iowa, including international students, may be held to higher academic standards, but must meet at least the same requirements as resident applicants.

Applicants who are graduates of non-approved high schools will be considered for admission in a manner similar to applicants from approved high schools, but additional emphasis will be given to scores earned on standardized examinations.

Applications may be considered from students who did not graduate with their high school classes. They will be required to submit all academic data to the extent that it exists and achieve scores on standardized examinations which will demonstrate that they are adequately prepared for academic study.

Students with satisfactory academic records may be admitted, on an individual basis, for part-time university study while enrolled in high school or during the summers prior to high school graduation.

Exceptional students may be admitted as full-time students before completing high school. Early admission is provided to serve persons whose academic achievement and personal and intellectual maturity clearly suggests readiness for college-level study.

Graduation from an approved high school shall ordinarily precede entrance into Iowa State University. Students who wish to enter Iowa State University directly from high school (or transfer from another college or university with less than 24 semester hours of graded transferable college credit) must meet the level of academic performance described above and show evidence of the following high school preparation:

- English/Language Arts: four years, emphasizing writing, speaking, and reading, as well as an understanding and appreciation of literature
- Mathematics: three years, including one year each of algebra, geometry, and advanced algebra
- Science: three years, including one year each of courses from two of the following fields: biology, chemistry, and physics
- Social Studies: two years

Tables 7.6.1 and 7.6.2, shows the ACT scores and the percentile rank for seniors enrolled in the Industrial Technology program, the College of Agriculture and Life Sciences, and Iowa State University.

Table 7.6.1 Comparison ACT Data of Seniors of Industrial Technology to the Seniors in the College of Agriculture and Life Sciences (CALS) and Iowa State University

Semester	ITec Student N	ITec Senior's Entering ACT	CALS Student N	CALS Senior's Entering ACT	University Student N	University Senior's Entering ACT
Fall 2002	65	22.7	555*	22.4*	5,068	24.5
Fall 2003	64	22.3	574*	22.2*	5,179	24.5
Fall 2004	55	21.7	661	23.5	5,335	24.6
Fall 2005	69	21.6	646	23.3	5,394	24.5
Fall 2006	59	22.1	622	23.4	5,165	24.5
Fall 2007	70	23.9	630	23.7	5,107	24.6

* This data is from the college of Education instead of the college of Agriculture and Life Sciences because the Industrial Technology students were in the college of Education until Fall 2004.

Table 7.6.2 Comparison High School Rank Data of Seniors of Industrial Technology to the Seniors in the College of Agriculture and Life Sciences (CALS) and Iowa State University

Semester	ITec Student Number	ITec Senior's High School Ranking	CALS Student N	CALS Senior's High School Ranking	University Student N	University Senior's High School Ranking
Fall 2002	69	68.8	548*	71.0*	5,472	75.2
Fall 2003	67	70.4	595*	70.4*	5,602	74.8
Fall 2004	60	67.6	700	72.4	5,708	75.0
Fall 2005	74	68.9	668	71.7	5,667	74.9
Fall 2006	58	62.9	587	73.3	5,332	75.0
Fall 2007	70	69.6	627	74.2	5,206	75.0

* This data is from the college of Education instead of the college of Agriculture and Life Sciences because the Industrial Technology students were in the college of Education until Fall 2004.

Tables 7.6.3 and 7.6.4, shows the ACT scores and the percentile rank for seniors enrolled in the Agricultural Systems Technology program, the College of Agriculture and Life Sciences, and Iowa State University.

Table 7.6.3 Comparison ACT Data of Seniors of Agricultural Systems Technology to the Seniors in the College of Agriculture and Life Sciences (CALS) and Iowa State University

Semester	AST Student N	AST Senior's Entering ACT	CALS Student N	CALS Senior's Entering ACT	University Student N	University Senior's Entering ACT
Fall 2002	58	23.5	659	23.5	5,068	24.5
Fall 2003	37	23.3	595	23.8	5,179	24.5
Fall 2004	49	23.4	661	23.5	5,335	24.6
Fall 2005	43	23.8	646	23.3	5,394	24.5
Fall 2006	35	22.3	622	23.4	5,165	24.6
Fall 2007	33	23.0	63	23.7	5,107	24.6

Table 7.6.4 Comparison High School Rank Data of Seniors of Agricultural Systems Technology to the Seniors in the College of Agriculture and Life Sciences (CALS) and Iowa State University

Semester	AST Student Number	AST Senior's High School Ranking	CALS Student N	CALS Senior's High School Ranking	University Student N	University Senior's High School Ranking
Fall 2002	59	72.2	701	73.1	5,472	75.2
Fall 2003	36	74.9	642	73.1	5,602	74.8
Fall 2004	48	73.9	700	72.4	5,708	75.0
Fall 2005	46	67.8	668	71.7	5,667	74.9
Fall 2006	31	76.2	587	73.3	5,332	75.0
Fall 2007	32	72.3	627	74.2	5,206	75.0

Student Retention Standards

Once a student is on campus at Iowa State University, the faculty and staff are dedicated to aid in their success. The university community dedicates itself to develop and maintain high-quality instructional programs that provide each student with the opportunity for personal success. Retention of our students until they graduate requires quality education and support programs. To this end, Iowa State University faculty and staff encourage students to meet with faculty and advisors early and often. Students are also encouraged to use the academic support programs that are readily available. Learning communities, tutors, help sessions, student counseling service, Academic Success Center, and learning skills development programs all influence retention. These are examples of resources provided at Iowa State University to help students succeed in their chosen field of study.

Iowa State University's academic policy states that grades must be given in terms of letters with the option of a plus or minus designation to indicate levels of achievement. The grading system is outlined on page 38 of the 2007-2009 Iowa State University Bulletin.

Grades issued to students are compiled by the Office of the Registrar to compute the student's semester grade point average (GPA) and an accumulated GPA. Academic standing, probation, and honors are based on the calculation of GPAs. GPAs are computed based on the following rating scale:

A	4.00 grade points per credit	C	2.00 grade points per credit
A-	3.67 grade points per credit	C-	1.67 grade points per credit
B+	3.33 grade points per credit	D+	1.33 grade points per credit
B	3.00 grade points per credit	D	1.00 grade points per credit
B-	2.67 grade points per credit	D-	0.67 grade points per credit
C+	2.33 grade points per credit	F	0.00 grade points per credit

The academic progress of students in the Agricultural Systems Technology and Industrial Technology programs are monitored closely by the academic advisor and by the faculty. Each college has an academic standards committee that is responsible for monitoring the academic progress of undergraduate students, based on policies and minimum requirements set by the Faculty Senate Committee on Academic Standards and Admissions and ratified by the Faculty Senate.

The college committees are responsible for actions involving individual students with respect to placing students on academic probation, dismissing students from the university for unsatisfactory academic progress, and reinstating students who have been dismissed.

Students are placed on academic probation status as a warning that their academic progress is not satisfactory and that they should take steps to improve their academic performance to avoid dismissal from the university. Students who are placed on academic probation should immediately seek assistance in academic improvement from such sources as academic advisers, instructors, the Student Counseling Service, and the Academic Success Center.

Continued enrollment at Iowa State University depends upon an undergraduate student maintaining satisfactory academic progress toward attaining a degree. To assist students in maintaining satisfactory progress, Iowa State University has adopted academic standards designed to provide early identification of students who are experiencing academic difficulty, and to provide timely intervention through academic advising and academic support programs.

Academic standing at Iowa State University is dependent upon the total number of credits a student has attempted or earned, the student's semester grade point average (GPA), the student's cumulative ISU GPA, and the student's transfer GPA (if below 2.00.)

While an Academic Warning (W) is the least severe of the negative academic actions, it serves as a reminder that future semesters below 2.00 could result in more serious consequences. In fact, a student on warning whose subsequent term GPA is below a 2.00 will be placed on probation (P) the following term.

Students will receive an academic warning (W) at the end of any fall or spring semester when they earn a GPA of 1.00 – 1.99 for that semester. At the end of the next semester of enrollment, one of the following actions will be taken for students on academic warning status:

- Students will be placed on academic probation if they earn less than a 2.00 GPA for the next fall or spring semester, or
- They will be removed from warning status if they earn at least a 2.00 semester GPA for the next fall or spring semester and they are not subject to academic probation based on cumulative GPA (over 75 credits).

Academic probation is an indication of very serious academic difficulty which may result in dismissal from the university. Students may be placed on academic probation as a result of either semester GPA, cumulative GPA, or both. (P) at the end of a semester/term for either of the following two reasons:

1. Semester GPA: Students who earn less than a 1.00 at the end of any fall or spring semester, or less than a 2.00 two consecutive semesters, will be placed on academic probation. Students will not be placed on academic probation at the end of the summer term due to summer term GPA.
2. Cumulative GPA: Students with 75 or more credits attempted or earned, whichever is greater, will be placed on academic probation at the end of any fall or spring semester or summer term when

their cumulative GPA is less than 2.00. Students with 75 or more credits attempted or earned who have a transfer GPA < 2.00 will be placed on academic probation at the end of any fall or spring semester or summer term when their combined transfer/ISU cumulative GPA is less than 2.00.

At the end of the next fall or spring semester of enrollment, one of the following actions will be taken for students on academic probation status:

- Students will be academically dismissed if they fail to earn at least a 2.00 semester GPA, or
- They will continue on academic probation if they earn at least a 2.00 semester GPA but are subject to continued academic probation based on their cumulative GPA (over 75 credits), or
- They will be removed from probation if they earn at least a 2.00 semester GPA and are not subject to continued academic probation based on their cumulative GPA (over 75 credits).

Students who do not meet the requirements of their academic probation are academically dismissed from the university. Each College Academic Standards Committee is responsible for final decisions regarding the academic status of students in that college, and any appeals to academic dismissal actions are considered by the college committee. Once dismissed, students are not allowed to reenroll at Iowa State University until they have been academically reinstated. (See section on reinstatement.) Academic dismissal is placed on the student's academic record as a permanent notation. The official transcript of a student who has been dismissed includes a "not in good standing" notation.

The scholastic success of students in Agricultural Systems Technology and Industrial Technology is comparable to that of students throughout the college and university. Data from the Office of Institutional Research show that GPAs of students in Agricultural Systems Technology and Industrial Technology compare favorably with GPAs of students from the college and university as a whole. See Table 7.6.5 and 7.6.6.

Table 7.6.5 Comparison GPA Data of Seniors of Agricultural Systems Technology to the Seniors in the College of Agriculture and Life Sciences (CALS) and Iowa State University

Semester	AST Student N	AST Senior's GPA	CALS Student N	CALS Senior's GPA	University Student N	University Senior's GPA
Fall 2002	61	2.91	879	2.82	6,755	2.96
Fall 2003	39	2.91	785	2.86	6,856	2.97
Fall 2004	55	2.97	867	2.88	6,899	2.98
Fall 2005	51	2.80	852	2.84	6,762	2.97
Fall 2006	35	2.80	622	2.92	6,405	2.98
Fall 2007	35	2.87	796	2.88	6378	2.99

Table 7.6.6 Comparison GPA Data of Seniors of Industrial Technology to the Seniors in the College of Agriculture and Life Sciences (CALS) and Iowa State University

Semester	ITec Student N	ITec Senior's GPA	CALS Student N	CALS Senior's GPA	University Student N	University Senior's GPA
Fall 2002	89	2.85	673*	3.01*	6,755	2.96
Fall 2003	95	2.82	705*	3.00*	6,856	2.97
Fall 2004	81	2.80	867	2.88	6,899	2.98
Fall 2005	89	2.68	852	2.84	6,762	2.97
Fall 2006	59	2.68	622	2.92	6,405	2.98
Fall 2007	80	2.69	796	2.88	6378	2.99

* This data is from the College of Education instead of the College of Agriculture and Life Sciences because the Industrial Technology students were in the college of Education until Fall 2004.

SECTION 7.7

Student Enrollment: *There shall be evidence of an adequate number of program majors to sustain the program, and to operate it efficiently and effectively. Program enrollment shall be tracked and verified.*

7.7 Student Enrollment: *There shall be evidence of an adequate number of program majors to sustain the program, and to operate it efficiently and effectively. Program enrollment shall be tracked and verified.*

Enrollment in undergraduate ABE programs has historically reflected the economy and demographic of Iowa and surrounding states. The farm crisis in the 1980s had a dramatic effect on the enrollment in the department's undergraduate curricula. Program enrollments were lowest during the 1988-89 period but have increased substantially since that time.

The undergraduate enrollment in Industrial Technology had been showing a general downward trend in enrollment since 1987, but has shown a long term upward trend since 2001 with minor fluctuation in semester based enrollment numbers. Figure 7.7.1 illustrates the enrollment trend of Industrial Technology since 2000. The average enrollment in Industrial Technology during the six year period (2002-2007) was 207 students. The Industrial Technology program has adequate number of student to sustain the program. All required and technical elective courses are being taught with full classes and have not been cancelled because of low student numbers. The population of Industrial Technology students average 6 percent female and 94 percent male with a total of 13 percent underrepresented minorities. The distribution of students in the Industrial Technology options are Manufacturing with 85% and Occupational Safety with 15%.

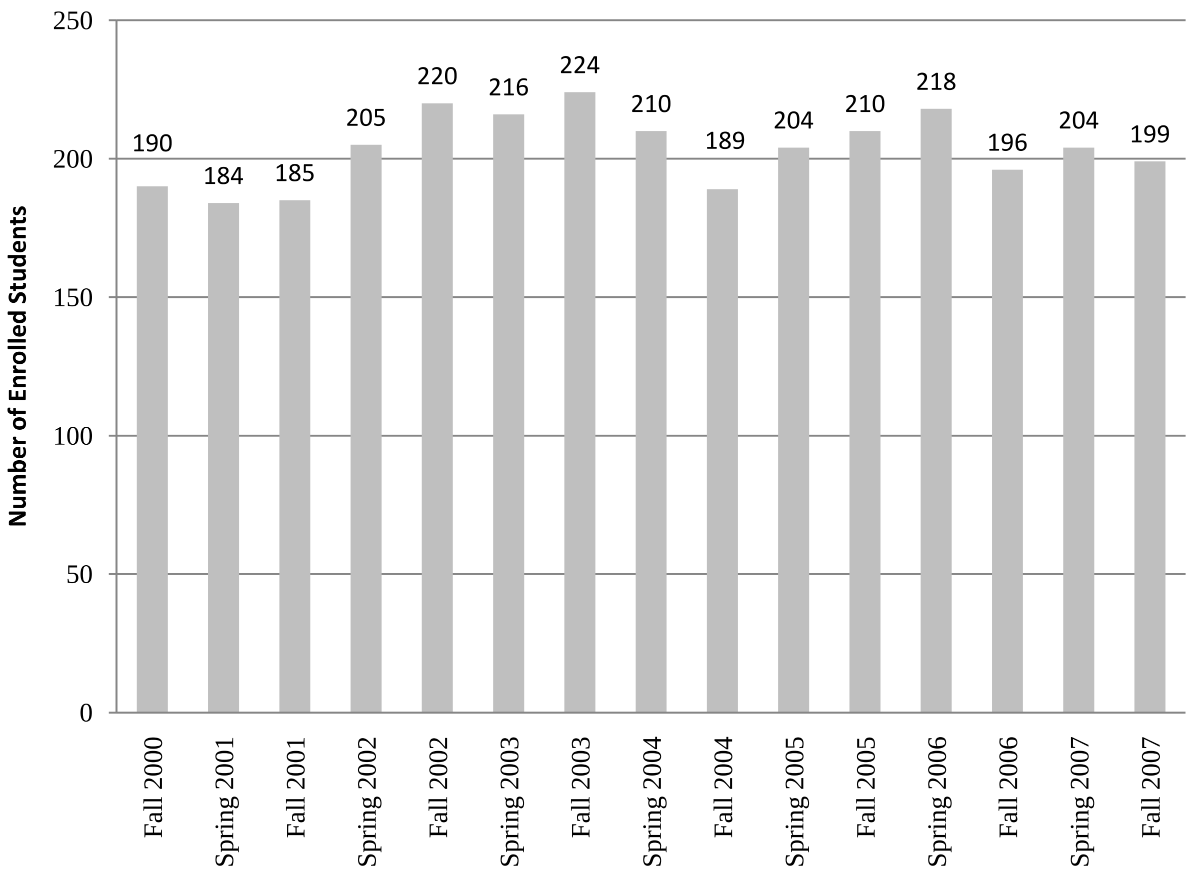

Figure 7.7.1 Enrollment Trends of Industrial Technology Students Since 2000

Figure 7.7.2 shows the enrollment trend by student classification of Industrial Technology since 2006. Typically the number of freshmen entering the Industrial Technology is not proportional to the number of seniors graduating from the program. The reason for this increase in the number of upper classmen is because of the high rate of transfer students entering the Industrial Technology program at sophomore or even junior years.

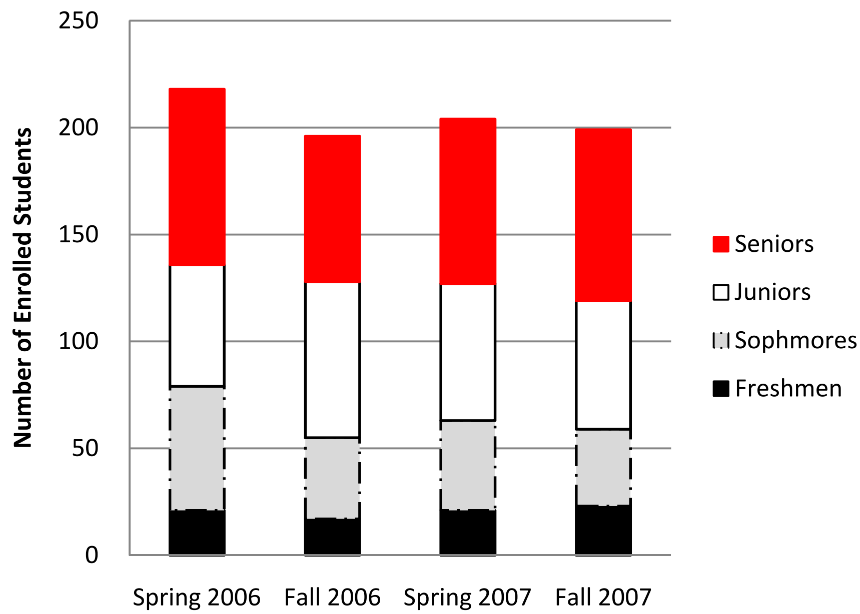

Figure 7.7.2 Enrollment Trends by Classification for Industrial Technology Students Since 2006

Undergraduate enrollment in Agricultural Systems Technology has been generally increasing since 1989 however there has been a noticeable drop in the last three semesters. Figure 7.7.3 illustrates the enrollment trend in the Agricultural Systems Technology program since 2000. The decrease in enrollment coincides with changes in the program philosophy that increased the academic rigor and the reduction of allowable course substitutions. The average enrollment in Agricultural Systems Technology during the six year period (2002-20007) was 129 students. The Agricultural Systems Technology program has adequate number of student to sustain the program. All required and technical elective courses are being taught with full classes and have not been cancelled because of low student numbers. The population of Agricultural Systems Technology students average 5 percent female and 95 percent male with a total of 2 percent underrepresented minorities. The distributions of students in the Agricultural Systems Technology options are Agricultural & Biosystems Management with 68% and Machine Systems with 32%.

Figure 7.7.4 shows the enrollment trend by student classification of Agricultural Systems Technology since 2006. Typically the number of freshmen entering the Agricultural Systems Technology is proportional to the number of seniors graduating from the program. The program has typically equal distribution among the student classifications but the program does receive some increases in student number from transfer coming in from a community college at the junior and senior level.

The combined totals of the undergraduate students in the technology degrees, position the ABE department as the second largest undergraduate enrollment in the College of Agriculture and Life Sciences. This growth in total departmental numbers has made the technology programs more visible to the Iowa State University recruiters and this new program status has increased the number of students being recruited without departmental resources.

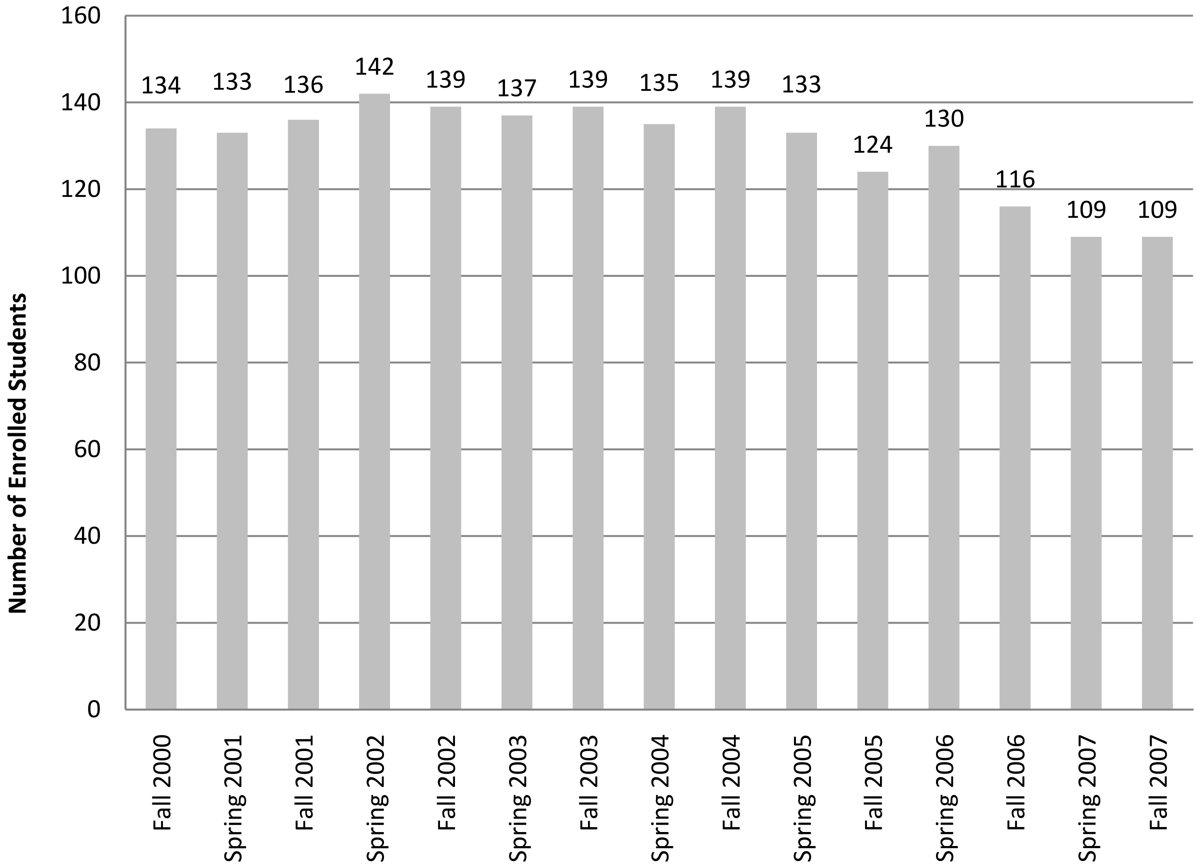

Figure 7.7.3 Enrollment Trends of Agricultural System Technology Students Since 2000

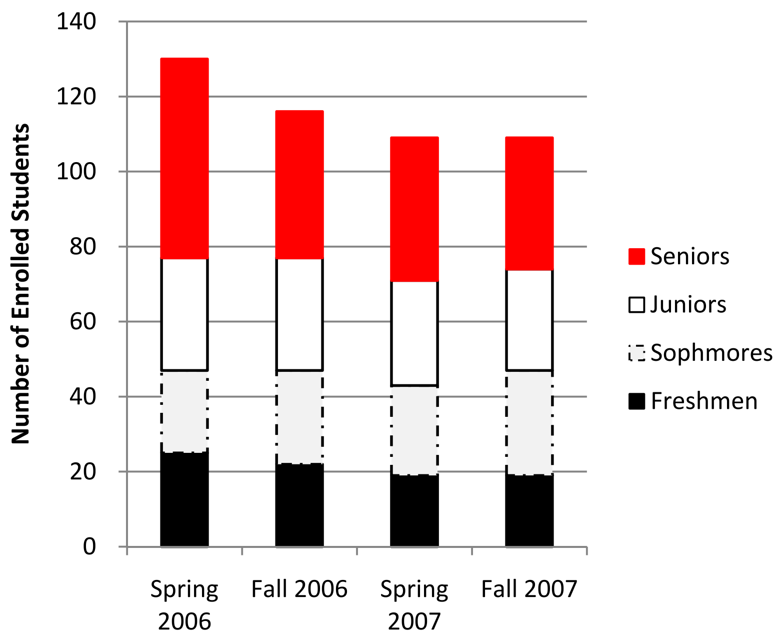

Figure 7.7.4 Enrollment Trends by Classification for Agricultural System Technology Students Since 2006

SECTION 7.8

Administrative Support & Faculty Qualifications: *There must be evidence of appropriate administrative support from the institution for the Industrial Technology program/option including appropriately qualified administrators, an adequate number of full time faculty members and budgets sufficient to support program/option goals. Full time faculty assigned to teach courses in the Industrial Technology program/option must be appropriately qualified. Faculty qualifications shall include emphasis upon the extent, currency and pertinence of: (a) academic preparation; (b) industrial professional experience (such as technical supervision and management); (c) applied industrial experience (such as applied applications); (d) membership and participation in appropriate Industrial Technology professional organizations; and (e) scholarly activities. The following minimum qualifications for full time faculty are required (except in unusual circumstances which must be individually justified):*

a. **Associate Degree:** *A bachelor's degree in a discipline closely related to the faculty member's instructional assignments.*

b. **Bachelor's Degree:** *A bachelor's and master's degree in a discipline closely related to the faculty member's instructional assignment. A minimum of fifty percent of the regular full-time faculty members assigned to teach in the major(s) program shall have an earned doctorate (exceptions may be granted for highly specialized programs or when a program is in place to achieve this standard within a reasonable length of time).*

c. **Master's Degree:** *A doctoral degree in a discipline closely related to the faculty member's instructional assignment (exceptions may be granted for specialized technical*

Policies and procedures for faculty selection, appointment, reappointment and tenure shall be clearly specified and shall be conducive to the maintenance of high quality instruction. Faculty teaching, advising and service loads shall be reasonable and comparable to the faculty in other professional program areas.

7.8 Administrative Support & Faculty Qualifications: *There must be evidence of appropriate administrative support from the institution for the Industrial Technology program/option including appropriately qualified administrators, an adequate number of full time faculty members and budgets sufficient to support program/option goals. Full time faculty assigned to teach courses in the Industrial Technology program/option must be appropriately qualified. Faculty qualifications shall include emphasis upon the extent, currency and pertinence of: (a) academic preparation; (b) industrial professional experience (such as technical supervision and management); (c) applied industrial experience (such as applied applications); (d) membership and participation in appropriate Industrial Technology professional organizations; and (e) scholarly activities. The following minimum qualifications for full time faculty are required (except in unusual circumstances which must be individually justified):*

a. ***Associate Degree*****:** *A bachelor's degree in a discipline closely related to the faculty member's instructional assignments.*
b. ***Bachelor's Degree:*** *A bachelor's and master's degree in a discipline closely related to the faculty member's instructional assignment. A minimum of fifty percent of the regular full-time faculty members assigned to teach in the major(s) program shall have an earned doctorate (exceptions may be granted for highly specialized programs or when a program is in place to achieve this standard within a reasonable length of time).*
c. ***Master's Degree:*** *A doctoral degree in a discipline closely related to the faculty member's instructional assignment (exceptions may be granted for specialized technical*

Policies and procedures for faculty selection, appointment, reappointment and tenure shall be clearly specified and shall be conducive to the maintenance of high quality instruction. Faculty teaching, advising and service loads shall be reasonable and comparable to the faculty in other professional program areas.

Appropriate Administrative Support for the Technology Programs/Options

Direct institutional support for the Industrial Technology and Agricultural Systems Technology programs consist of support for faculty, staff, facilities, equipment, and operational maintenance. The total budget for the department is provided by a combination of resources from the College of Agriculture and Life Sciences, College of Engineering, the Agricultural and Home Economics Experiment Station, and University Extension. The total state budget for the department for FY2008 is about $4.31M. The total department teaching budget from the College of Agriculture and Life Sciences and College of Engineering is $2.38M. The budget figures for the department in previous years are listed in Table 7.8.1.

Table 7.8.1 ABE Departmental Total and Teaching Budgets for Past Four Years

Year	Total Budget	Teaching Budget
FY 2004	$3.18M*	$1.17M*
FY 2005	$3.36M	$1.84M
FY 2006	$3.69M	$1.98M
FY 2007	$3.96M	$2.19M

* Budgets values are prior to departmental merger.

There are a total of 11.85 FTEs (including instructors) in teaching positions in the department. The Industrial Technology and Agricultural Systems Technology student credit hours are approximately 60% of the total of Student Credit Hours annually. Therefore, the Industrial Technology and Agricultural Systems Technology programs have approximately 7.1 FTEs in teaching. Leadership from both Colleges of Agriculture and Life Sciences and Engineering has been outstanding. Whenever a budget matter for teaching functions arises, leadership is always willing and able to give advice and assistance in arriving at solution.

Table I-5 lists support expenditures for the past three years and the projected support expenditures for FY 2007. Although budget support has increased in recent years, it has not kept pace with the growth of the department needs. In the past six years, department have eliminated 4 staff positions in order to meet budget constraints. Currently the department has little money for teaching assistantships; most is available from faculty salary savings due to buy-outs from research or administrative positions. The department receives no funds for new teaching equipment (other than computers and software funded through the College of Engineering's Engineering Fee Task Force) nor to maintain the existing equipment. New equipment used for teaching is often purchased with research grants or donated by industrial partners. Some courses have relied on course fees to provide resources to replace laboratory expendables or travel expenses for travel to field laboratories and industrial tours.

While the department competes well for one-time funding initiatives for teaching (learning communities, laboratory remodeling, faculty development, etc.), adequate base funding for maintaining and improving teaching programs continues to be a concern for the department.

The College of Engineering recently implemented a tuition surcharge of $750 per semester for all upper-class engineering students. Starting in the summer 2006, these students were charged $250. Each subsequent year it will go up by $250 until the cap of $750 is reached. This new revenue for the College will be used exclusively for teaching improvement — laboratories, equipment, new faculty and related expenses. The ABE department will receive significant funds that we will use to improve our teaching laboratories that are used by all ABE students (AE, AST, and ITec).

The department has made significant improvements in the instructional facilities since 2002 (see Figures B.6.2 and B.6.3). The department has been successful in competing on campus for funding to provide a first-class computer laboratory for undergraduate students. A significant proportion of remodeling funds went to improve both teaching and research laboratories.

In addition to the facilities and faculty in the Agricultural and Biosystems Engineering department, students have access to facilities and faculty from the various departments in the Colleges of Engineering and Agriculture and Life Sciences. Students are provided access to excellent facilities in other departments on the campus. This builds an awareness of the skills and abilities of other disciplines upon which our department is based.

Faculty has been very successful in obtaining competitive grant funding for improving student retention rates through learning communities, study abroad programs, and in building teaching and research laboratories. Faculty has excellent relationships with industry and routinely get donations of laboratory equipment worth hundreds of thousands of dollars. Recently we have received grants from Cargill, ADM, Sauer Danfoss, John Deere and many other small companies to help us in setting up student learning laboratory; strengthen our biomaterials, hydraulics, and biofuels labs; and farm power and machinery. This year John Deere donated us brand new 7000 series tractor with latest sensors and controls worth more than $150,000 so that students can gain experience on this state-of-the-art machine of 21st century. We received more than $250,000 within last three years from the Dean College of Agriculture and Life Sciences and the ISU President to renovate class rooms and teaching labs (computer, controls and sensors, robotics, manufacturing, and safety engineering). Renovating these labs has been completed and remaining renovations would be completed before ABET visit in October. In addition, some faculty have used their start up funds to build their labs.

Adequate Number of Full Time Faculty Members

The faculty in the Agricultural and Biosystems Engineering Department consists of 31 full-time professionals. Faculty attending the departmental winter retreat are shown in figure 7.8.1 (not all faculty were able to attend or participate in this picture). Included within that group are one adjunct assistant professor, nine assistant professors, twelve associate professor, and nine full professors. All of these faculty members are active within their profession and strongly committed to their students, department, colleges, and the University. Additionally, seven ISU faculty in other departments or in industry have courtesy appointments in ABE because of close interdisciplinary work with ABE faculty. Primary responsibility for teaching TSM courses rests with 20 of the full-time, professionals, although every faculty member has interactions with Agricultural Systems Technology and Industrial Technology students. Faculty are highly engaged with the undergraduate student through learning community events, undergraduate research experiences, and departmental socials. Résumés for all tenured or tenure-track faculty in ABE are found in Appendix 7.8.

The full-time tenured and tenure-track faculty in ABE currently includes:

Faculty Name, Rank	**University That Awarded Highest Degree**
Dr. Robert Anex, Associate Professor	University of California, Davis
Dr. Carl Bern, University Professor	Iowa State University
Dr. Alok Bhandari, Associate Professor	Virginia Tech
Dr. Stuart Birrell, Associate Professor	University of Illinois, Urbana-Champaign
Dr. Thomas Brumm, Associate Professor	Iowa State University
Dr. Robert Burns, Associate Professor	University of Tennessee
Dr. Joseph Chen, Professor	Auburn University
Dr. Matthew Darr, Assistant Professor	Ohio State University
Dr. Steven A. Freeman, Associate Professor	Purdue University
Dr. Thomas Glanville, Professor	Iowa State University
Dr. David Grewell, Assistant Professor	Ohio State University
Dr. Jay Harmon, Professor	Virginia Tech
Dr. Matthew Helmers, Assistant Professor	University of Nebraska, Lincoln
Dr. Steven Hoff, Professor	University of Minnesota
Dr. Charles Hurburgh, Professor	Iowa State University
Dr. Amy Kaleita, Assistant Professor	University of Illinois ,Urbana-Champaign
Dr. Rameshwar Kanwar, Professor	Iowa State University
Dr. Nir Keren, Assistant Professor	Texas A&M University
Dr. Tae Hyun Kim, Assistant Professor	Auburn University
Dr. Jacek Koziel, Associate Professor	University of Texas, Austin
Dr. Steven Mickelson, Associate Professor	Iowa State University
Dr. Raj Raman, Associate Professor	Cornell University
Dr. Charles Schwab, Professor	University of Kentucky
Mr. James Shahan, Adj. Assistant Professor	Iowa State University
Dr. Shana S-F. Smith, Associate Professor	Iowa State University
Dr. Michelle Soupir, Assistant Professor	Virginia Tech
Dr. Brian Steward, Associate Professor	University of Illinois ,Urbana-Champaign
Dr. Lie Tang, Assistant Professor	University of Illinois ,Urbana-Champaign
Dr. Sunday Tim, Associate Professor	Concordia University, Montreal
Dr. Hongwei Xin, Professor	University of Nebraska
Dr. Chenxu Yu, Assistant Professor	University of Wisconsin, Madison

The faculty with courtesy appointments in ABE currently includes:

Faculty Name, Rank	**University That Awarded Highest Degree**
Dr. Robert Brown, Professor	Michigan State University
Dr. John Downing, Professor	McGill University, Montreal
Dr. Lawrence Johnson, Professor	Kansas State University
Dr. Ardith Maney, Professor	Columbia
Dr. Manjit Misra, Professor	University of Missouri
Dr. Santosh Pandey, Assistant Professor	Lehigh University
Dr. Johannes Van Leeuwen, Professor	University of Petroia

Figure 7.8.1 Agricultural and Biosystems Engineering Faculty at the Winter 2007 Retreat

Faculty Qualifications

Nineteen ABE faculty are actively engaged in teaching TSM courses and ten ABE faculty involved in academic advising. Each faculty member has a strong education background necessary for delivering our curriculum. We have faculty from diverse backgrounds, engineering experience, and teaching experience; with a good cross-section of faculty expertise in each program option area and strong leadership in professional societies. All ABE faculty are active in professional development activities. Faculty members demonstrate strong citizenship by being chairs and members on many department, college, and university committees. A two page vita for all ABE faculty is located in Appendix 7.8.

Faculty competence can be judged by factors such as academic preparation, diversity of backgrounds, engineering experience, teaching experience, participation in professional societies, licensure as Professionals, and scholarly activities.

- 30 of 31 ABE faculty currently on staff hold Ph. D.s
- Highest degrees of all ABE faculty are from 22 different universities
- Seven ABE faculty represent ethnic minorities
- Four ABE faculty are women
- Eleven ABE faculty have engineering experience outside the US
- Thirteen ABE faculty have employment or consulting experience in industry
- ABE faculty are engaged with 36 technical and professional societies with highest participation for American Society of Agriculture and Biological Engineering (ASABE), American Society of Engineering Educators (ASEE), Sigma Xi, and National Association of Industrial Technology (NAIT) respectively.
- Two are fellow members of a technical or professional society.
- Seven ABE faculty are licensed Professional Engineers (PE) and One faculty is a licensed Safety Professional (CSP)
- ABE faculty produce 83 journal articles per year
- The average research expenditures for ABE faculty is 5.2 million dollars per year

The department has a well balanced distribution of faculty to be available to teach, mentor and advice undergraduate students. An indication of the competency of the teaching faculty is their recognition for performance in the classroom and service to students. In 2005, Carl Bern received the ISU Foundation’s Award for Outstanding Achievements in Teaching (Carl also received ASABE Massey-Ferguson Education Medal in 2004), Steve Hoff received College of Engineering Award for Superior Teaching, Brian Steward received NACTA’s Jack Everly Journal Award, Steve Mickelson received ISU Foundation’s Award for Excellence in Academic Advising, Steve Freeman received National Association of Industrial Technology 2007 Outstanding Industrial Technology Professor Award, and Amy Kaleita received the following teaching awards: Early Achievement in Teaching Award, Iowa State University, 2006; Outstanding Early Achievement in Teaching, Iowa State University College of Agriculture, 2006; and 2007 National New teacher award given by US Department of Agriculture and National Association of State University and Land grant colleges. These teaching awards are the recognitions of our faculty for providing an excellent environment for student teaching and learning.

Faculty Retention and Changes

The primary strength of our department has been in its faculty. We have one of the most outstanding faculty on the campus, and perhaps in the country. Retention of outstanding faculty is department and university’s top priority. The Department Chair maintains a constant dialogue with faculty and encourages faculty to visit with him on any issues including faculty retention. Department takes a proactive approach in assessing individual faculty needs, such as spousal accommodation, competitive salary adjustments/awards and annual raises, outstanding start up packages, adjustments in teaching loads and committee work for newly hired faculty for first few years of their appointment, and recognition by nominating them to various awards. The department firmly believes in the reward system that values excellence in scholarship and good citizenship.

After recruitment, the department goal is to make faculty successful. Each of the nine faculty were given a start up package of about $200,000 whereas one faculty received a startup package of $420,000. This allowed newly hired faculty to have money for travel for three years, buy computers, set up their labs, and recruit at least two graduate students on assistantships. Also, the department believes strongly in the faculty mentoring program and each newly hired faculty is given a senior faculty as their mentor. The purpose of providing outstanding mentors is to guide faculty on how to become successful in their careers, achieve promotion and tenure, take advantage of professional development opportunities, and become good department and university citizens.

Between 2002 and 2005, 9 faculty retired, 5 faculty resigned to take opportunities elsewhere, and 2 were denied tenure. The colleges allowed us to initially fill 6 of these positions with tenure track faculty. All six were teaching/research faculty with a minimum of 50% teaching appointment and recruited some of the best faculty in the country with Ph.D.s from excellent institutions (2 from University of Illinois, 1 from Cornell, 1 from the University of Nebraska, 1 from the University of Tennessee, and 1 from the University of Texas). Out of these six, only two came immediately from Ph.D. programs. The other 4 had 3-10 years of faculty experience at other institutions. We were then able to recruit 3 more tenure track faculty (with 50% teaching appointments) in 2004 and 2005. These three received their Ph.D.s from Ohio State University, Texas A&M University, and University of California Davis. Five additional tenure track faculty were recruited in 2005 through 2007. This latest group received their Ph.D.s from Ohio State University, Virginia Tech (2 faculty), Auburn University, and the University of Wisconsin. One of these last 5 was also a senior faculty hire at the rank of Associate Professor. Thus, a total of 14 new tenure track faculty were recruited in last six years and all have Ph.D. degrees from excellent universities.

Faculty Selection and Appointment Policy and Procedures

Recruiting and retaining the outstanding faculty is one of the major departmental challenges. As opportunities for recruiting new faculty become available, teaching needs have been department’s foremost priority. The chair initiates a proposal for a new appointment after consultation with the members of the department. Upon receipt of approval from the dean(s) and provost, the department follows university search procedures http://www.adp.iastate.edu/vpbf/prod/docs/opg/chap4.htm#4.1.1.

When a candidate has been identified for the appointment, the chair specifies the conditions of appointment on a form called the Letter of Intent and in a letter making the offer of appointment including the position responsibility statement.

The Letter of Intent form and the letter must be approved by the dean and, in the case of a tenured or tenure eligible appointment, by the provost. Approval must also be obtained from the Office of Equal Opportunity and Diversity confirming that the required search procedures have been followed in filling the position. The stipulated conditions include the academic rank, salary for the first year (in the case of new appointment), the ending date of the probationary period if one is established, the date by which a notification of intent not to renew is to be given if the appointment is renewable, and any special factors that apply to the appointment.

Subsequently, the person to whom the appointment is offered signs the form, indicating acceptance of the appointment and the specified conditions.

Faculty Appointments are made as tenured/tenure-eligible (with rank of assistant professor, associate professor, or professor) or as non-tenure-eligible (e.g. lecturer, clinician, senior lecturer, senior clinician, instructor, adjunct, affiliate, collaborator or visiting faculty). The type of appointment influences such considerations as fringe benefits, tenure status, and renewal procedures. Appointments to the faculty are ordinarily made for the nine-month academic year (B-base). Twelve-month A-base appointments are reserved for administrative positions and for persons whose responsibilities require year-round service. As professionals, faculty members and administrators arrange their own work schedules during their appointment periods so as to carry out their on-going responsibilities to the university.

Faculty Tenure Policy and Procedures

Academic freedom is the freedom to discuss all relevant matters in the classroom, to explore all avenues of scholarship, research, and creative expression and to speak or write as a public citizen without institutional discipline or restraint. Academic responsibility implies the faithful performance of academic duties and obligations, the recognition of the demands of the scholarly enterprise, and the candor to make it clear that the individual is not speaking for the institution in matters of public interest.

Tenure is the keystone for academic freedom; it is essential for safeguarding the right of free expression and for encouraging risk-taking inquiry at the frontiers of knowledge. Both tenure and academic freedom are part of an implicit social compact, which recognizes that tenure serves important public purposes and benefits society. The public is best served when faculty are free to teach, conduct research, provide extension/ professional practice services, and engage in institutional service without fear of reprisal or without compromising the pursuit of knowledge and/or the creative process.

In return, faculty have the responsibility of furthering high-quality programs of research, teaching, and extension/professional practice, and are fully accountable for their performance of these responsibilities. Additionally, a well-designed tenure system attracts capable and highly qualified individuals as faculty members, strengthens institutional stability by enhancing faculty members' institutional loyalty, and encourages academic excellence by retaining and rewarding the most meritorious people. Tenure and promotion imply selectivity and choice; they are granted for scholarly and professional merit. The length and intensity of the review leading to the granting of tenure ensures the retention of only productive faculty; periodic performance reviews ensure the continuance of a commitment to excellence.

The system of academic tenure at Iowa State University emphasizes (1) recruitment of the most highly qualified candidates available, (2) creation of an opportunity for scholarly performance in teaching, research/creative activity, and extension/professional practice, (3) continuing evaluation of performance on the basis of areas of responsibilities in the employment agreement, and (4) the positive evaluation of performance resulting in the award of tenure. The awarding of tenure requires an affirmative decision, based upon an explicit judgment of qualifications resulting from continuous evaluation of the faculty member during the probationary period in light of the applicable criteria.

Iowa State University is a public land-grant institution where liberal and professional education is merged with basic and applied research in pursuit of advancing society's potentials and assisting in solving its problems. The university serves the people of Iowa, the nation, and the world through its interrelated programs of teaching, research/creative activities, and extension/professional practice.

Evaluation of a faculty member for promotion and/or tenure is based primarily on evidence of scholarship in the faculty member's teaching, research/creative activities, and/or extension/professional practice. In all areas of professional activity, a faculty member is expected to uphold the values and follow the guidelines in the Statement of Professional Ethics found in "Professional Policies and Procedures."

A key tool in the promotion and tenure review process is the position responsibility statement, which describes the individual's current position responsibilities and activities in the following areas: (1) teaching, (2) research/creative activities, (3) extension/ professional practice, and (4) institutional service. This statement is used by all evaluators to interpret the extent, balance, and scope of the faculty member's scholarly achievements.

All tenured and probationary faculty members are expected to engage in scholarship in their teaching, research/creative activities, and extension/professional practice. Scholarship is creative, systematic, rational inquiry into a topic and the honest, forthright application or exposition of conclusions drawn from that inquiry. It builds on existing knowledge and employs critical analysis and judgment to enhance understanding. Scholarship is the umbrella under which research falls, but research is just one form of scholarship. Scholarship also encompasses creative activities, teaching, and extension/professional practice.

Scholarship results in a product that is shared with others and is subject to the criticism of individuals qualified to judge the product. This product may take the form of a book, journal article, critical review, annotated bibliography, lecture, review of existing research on a topic, or speech synthesizing the thinking on a topic. Also falling under the umbrella of scholarship are original materials designed for use with the computer; inventions on which patents are obtained; codes and standards; art exhibits by teacher-artists; musical concerts with original scores; novels, essays, short stories, poems; and scholarly articles published in non-research based periodicals, newspapers, and other publications; etc. In short, scholarship includes materials that are generally called "intellectual property."

Scholarship generally implies that one has a solid foundation in the professional field addressed and is current with developments in that field. However, it must be noted that significant advances sometimes accrue when a scholar extends her or his scope of topics beyond those traditional to a particular discipline.

An assistant professor should have a strong academic record and ordinarily should have earned the accepted highest degree in his/her field. The assistant professor rank is recognition that the faculty member has exhibited the potential to grow in an academic career. Appointment at or promotion to this rank should be based on evidence that the faculty member can be expected to become qualified for promotion to associate professor in due course.

An associate professor should have a solid academic reputation and show promise of further development and productivity in his /her academic career. The candidate must demonstrate the following: excellence in scholarship that establishes the individual as a significant contributor to the field or profession, with potential for national distinction, effectiveness in areas of position responsibilities, and satisfactory institutional service. Furthermore, a recommendation for promotion to associate professor and granting of tenure must be based upon an assessment that the candidate has made contributions of appropriate magnitude and quality and has a high likelihood of sustained contributions to the field or profession and to the university.

A professor should be recognized by his/her professional peers within the university, as well as nationally and/or internationally, for the quality of the contribution to his /her discipline. The candidate must demonstrate the following: national distinction in scholarship, as evident in candidate's wide recognition and outstanding contributions to the field or profession, effectiveness in areas of position responsibilities, and significant institutional service. Furthermore, a recommendation for promotion to professor must be based upon an assessment, since the last promotion, that the candidate has made contributions of appropriate magnitude and quality and has demonstrated the ability to sustain contributions to the field or profession and to the university.

Additional information on the policies and procedures on promotion and tenure are found in :

Source	**Location**
ABE Departmental Governance Document	http://www.abe.iastate.edu/who-we-are/its-a-fact.html
College of Agriculture and Life Sciences	http://www.ag.iastate.edu/agcoll/ptresources.php http://www.ag.iastate.edu/agcoll/COAGovDoc-June2007.pdf
Office of the Executive Vice President and Provost	http://www.provost.iastate.edu/faculty/advancement/promotion.html
Iowa State University Faculty Handbook	http://www.provost.iastate.edu/faculty/handbook/faculty_handbook/

SECTION 7.9

Facilities, Equipment & Technical Support: *Facilities and Equipment, including the technical personnel support necessary for maintenance, shall be adequate to support program/option goals. Evidence shall be presented showing the availability of computer equipment and software programs to cover functions and applications in each program area. Facility and equipment needs shall be included in the long range goals for the program.*

7.9 Facilities, Equipment & Technical Support: *Facilities and Equipment, including the technical personnel support necessary for maintenance, shall be adequate to support program/option goals. Evidence shall be presented showing the availability of computer equipment and software programs to cover functions and applications in each program area. Facility and equipment needs shall be included in the long range goals for the program.*

Facilities

The Agricultural and Biosystems Engineering (ABE) Department has major facilities in four building on the ISU Campus: Davidson Hall, Industrial Education I (I Ed I), Industrial Education II (I Ed II), and the National Swine Research Information Center (NSRIC) (see appendix 7.9 for floor plans of these four buildings). Davidson Hall houses the departmental administrative office and about a third of the ABE faculty. ABE has facilities in four buildings, totaling 72,153 square feet as shown in Table 7.9.1. We utilize an additional research lab space of 7,000 square feet in Food Science. We also have office space in the Food Science building and Howe Hall.

Table 7.9.1. Agricultural and Biosystems Engineering Overall Space in Each Building

ABE Building	Total Space (sq. ft.)
Davidson Hall (including AE Machine Shed)	32,008
Industrial Education I (I Ed I)	8,217
Industrial Education II (I Ed II)	18,312
National Swine Research Information Center	13,616
Total	72,153

In July of 2004, we integrated the Industrial Education and Technology program into our department. With this merger we obtained the Industrial Education I and Industrial Education II buildings. In the summer of 2005, several rooms in I Ed II were renovated to allow increased quality space for shared teaching of AE and TSM courses and for supporting the ABE Learning Communities. It is important to note that the ABE department is in the process of planning and fund raising for a new departmental facility that will be a part of the Biorenewables Complex. The Schematic designs for the Biorenewable Complex including the Biorenewables Research Laboratory, Agricultural and Biosystems Engineering, and West Campus Parking Structure are provided in Appendix 7.9. The ABE Building project has been approved by the university as well as the Board of Regents, State of Iowa. Another part of the good news is the vital step in our efforts to make this building project a reality has already taken place. In June of 2006, an Iowa State alumnus has come forward and made a $5 million pledge to the ABE Building project. This commitment is a wonderful gift, and it provides us with great momentum. The site for the new building has been selected between Howe Hall and the Design College on the west side of campus, near other engineering buildings. The Office of Biorenewable Programs, one of ISU’s key initiatives, will be part of the building. Optimistically, we could be breaking ground within two years, realistically within five years.

In addition to our new building process, the construction project for the Chemistry department also impacts our facility because their new building will occupy the current space of our I Ed I and AE Machine Shed buildings. The Chemistry building construction is scheduled for summer 2008 so the removal of the buildings will be taking place shortly. The teaching classrooms and laboratories located in those buildings are being relocated to other sites (Davidson Hall and Old Library storage) this semester. There are multiple stages as the department proceeds toward the new building and too numerous to report in this document. The department and colleges are acutely aware of the impact of these transitions for the undergraduate students and both are trying to minimize any negative ones. The end result of a new departmental building with capacity to house all ABE faculty will strengthen the department. Optimistically, we could be breaking ground within two years, realistically within five years.

Classrooms

Current classroom usage can be found in Table 7.9.2 and 7.9.3. Three classrooms (115 Davidson: capacity 40 persons, 110 Davidson: capacity 32 persons, 124C Davidson: capacity 24 persons) are used for many of the Technology classes. Room 115 Davidson is a high-tech classroom containing a projection system for computer, slides, transparencies, videos, and hard print. A mobile projection system housed in Davidson Hall is available for use in other classrooms and laboratories. I Ed II has three classrooms that are now also used by instructors of TSM courses. These rooms include 101, 201, and 224. Rooms 101 and 224 are considered university classrooms and are therefore maintained and controlled by the university. Our programs have first rights for course assignment in these rooms; and then remaining open time slots are made available to the university at large, through the ISU Office of Space and Scheduling.

Table 7.9.2. Lecture Classrooms in Davidson Used Extensively for Undergraduate Technology Instruction

Room	Area (ft^2)	Seating	TSM classes taught	Comment
110	760	32	322, 330, 333, 337, 363, 408, 415, 433	Renovated 2005
115	755	40	324, 335, 363, 426	University Classroom, Renovated 2006
124C	585	32	240, 330, 337, 424	Renovated 2003 and Renovated 2007
135	867	24	424	
143	861	18	363	Updated 2005

Table 7.9.3. Lecture Classrooms in Industrial Education II Used Extensively for Undergraduate Technology Instruction

Room	Area (ft^2)	Seating	TSM classes taught	Comment
101	1,236	80	201, 210, 240, 270, 272, 276, 301, 310, 370, 372, 401, 465, 477	University Classroom
124	913	48	110, 111, 415, 416, 477	Renovated 2005
201	1,867	40	115, 116, 216, 443	Renovated 2005
224	913	48	274, 340, 440, 444, 470	

Extensive reallocation and renovation of Davidson Hall and I Ed II laboratory space has been completed or initiated since the last accreditation visit. Tables 7.9.4, 7.9.5, and 7.9.6 describes these laboratories. Courses that use these laboratories are also shown in this table. Having our teaching laboratories spread across campus in three different buildings is very inefficient, allowing little sharing of equipment and tools between courses. As a result of the above, we believe that the condition and dispersion of our facilities is the primary factor limiting program improvement and expansion. We are confident that a new ABE facility will be built in the near future, and as this report is being written, developments are occurring quickly.

Equipment

Students have access to three machine shop areas for projects in all TSM courses. All AE students are required to complete safety training before using any of these facilities. This training can be completed individually with the guidance of our shop staff (Marc Lott or Richard VandePol) or in TSM 110 during the second semester of the freshman year. Safety training includes watching a safety video, completing an online fire safety module, and in-shop safety training. Individual tool and equipment requires one-on-one

Table 7.9.4. Laboratories in Davidson Used Extensively for Undergraduate Technology Instruction

Room	Area (ft^2)	Type	TSM classes taught	Comment
125D	707	Computer Lab	Open computer lab when courses are not in session.	3 year cycle hardware and software upgrading, projector 2005
125E	608	Computer Lab	Open computer lab when courses are not in session.	3 year cycle hardware and software upgrading
142	1716	Biomaterials Lab	111, 322	
143	861	Electric Power and Electronics Lab	111, 363	Renovated 2005
147	1260	Deere Engines Lab	111, 335	
150	1013	Fluid Power Laboratory	111, 337	Renovated 2004

Table 7.9.5. Laboratories in AE Machine Shed Used Extensively for Undergraduate Technology Instruction

Room	Area (ft^2)	Type	TSM classes taught	Comment
170	2251	Power and Machinery Laboratory	111, 330, 335, 337	

Table 7.9.6. Laboratories in Industrial Education II Used Extensively for Undergraduate Technology Instruction

Room	Area (ft^2)	Type	TSM classes taught	Comment
10	1548	Electronic Sensor/ Controls Lab	465	Renovated 2005
10A	751	Computer Laboratory	Open computer lab when courses are not in session.	3 year cycle hardware and software upgrading
10D	869	Teaching laboratory	440	
40	1093	CNC Lab	340	
42	1492	Safety Lab	471	Renovated 2005
117	265	Study Room	Learning Communities	Renovated 2005
119	331	Computer Laboratory	Open computer lab	Renovated 2005
201	1867	Computer Laboratory	115, 116, 216, AE 271, AE 272	Renovated 2005 3 year cycle hardware and software upgrading

training by the shop staff. Students are not allowed to work in any shop without shop supervision. Each shop has lathes, mills, drill presses, band saws and many hand tools. Davidson 132 (being relocated to I Ed II) is the main shop area for projects. The Agricultural Research Farm also has shop facilities that can be used for any course projects. I Ed I also has shop facilities.

Key equipment for our teaching labs can be found in Table 7.9.7- Table 7.9.9. Individual faculty members are in charge of these labs to ensure lab safety, equipment training, equipment maintenance, lab neatness, and overall oversight.

Computing and Information Infrastructure

ABE currently maintains five computer labs, two labs in Davidson Hall (125D and 125E), and three labs in IEDT II (10D, 119, and 201). ABE presently is on a three year schedule to replace lab computers. Software available in the computer labs include; ArcView GIS, Autodesk Software (AutoCAD, Inventor, Mechanical Desktop, etc.), JMP Statistical, MatLAB, Microsoft Office 2007 Pro, Pro/Engineer and Pro/Mechanica, Solid Edge, SolidWorks, Staad Pro, and Visual Studio. The computer labs also have class specific software installed.

Table 7.9.7. Key Equipment and Tools in TSM Teaching Laboratories in Davidson Used Extensively for Undergraduate Technology Instruction

Room	Area (ft^2)	Type	Key Equipment and Tools	Faculty In Charge
125D	707	Computer Lab	10 Dell Optiplex computers and 10 Dell Precision Workstations; scanner; laser printer	Raman
125E	608	Open Computer Lab	16 Dell Optiplex computers; scanner; laser printer	Raman
142	1716	Biomaterials Lab	Grain dryers, grain moisture testers, hood, MTS-Syntech (materials testing workstation), grain respirometer, controlled environment chambers	Bern
143	861	Electric Power and Electronics Lab	Oscilloscopes, programmable logic controllers, motors, electric meters, array of electrical measurement devices, generator	Bern
147	1260	Deere Engines Lab	John Deere 4.6L diesel engines (10), John Deere diesel engine + dynamometer, Brigg and Stratton 5 hp small engines (15)	Birrell
150	1013	Fluid Power Laboratory	Sauer-Danfoss electro-hydraulic test stands (3) (should be 6 by fall), Parker electro-hydraulic test stand (1), Vickers hydraulic test stands (2), pneumatic test stands (2), PID controllers, Sauer Danfoss hydrostatic transmissions, Husco valves, misc. hydraulic components	Steward

Table 7.9.8. Key Equipment and Tools in TSM Teaching Laboratories in AE Machine Shed Used Extensively for Undergraduate Technology Instruction

Room	Area (ft^2)	Type	Key Equipment and Tools	Faculty In Charge
170	2251	Power and Machinery Laboratory	John Deere 7920 Tractor, soil tillage bin, transmission test stand, seed metering stands, miscellaneous equipment cut-aways	Birrell, Steward

Table 7.9.9. Key Equipment and Tools in TSM Teaching Laboratories in Industrial Education II Used Extensively for Undergraduate Technology Instruction

Room	Area (ft^2)	Type	Key Equipment and Tools	Faculty In Charge
10	1548	Electronic Sensor/ Controls Laboratory	Pentium II Computers (10), oscilloscopes (12), power supplies (12), data acquisition boards (20)	Tang, Hoff
10A	751	Computer Laboratory	25 Dell Optiplex GX 745, 2.4GHz Core2Duo, with Dell Single 20” flat panels. Laserjet printer and plotter	Raman
10D	869	Lean/Six Sigma Lab	Lean 101 Kit	Chen
40	1093	CNC Lab	Fadol VMC, Storm Lathe, Daninci CNC Mill (2), Lathe, Servo metal manual saw	Chen
42	1492	Safety Lab	Air monitor, Sound meters, Light meters, and Slip meters.	Keren, Freeman
117	265	Learning Community Study Room	4 Dell Optiplex GX 620, 3.0 GHz, Dell Single 19” flat panels, scanner	Mickelson
119	331	Computer Laboratory	14 Dell GX 280, 3.GHz, Dell Single 19” flat panels, LaserJet Printer	Raman
201	1867	Computer Laboratory	27 Dell Optiplex GX 745, 2.4GHz Core2Duo, Dell Dual 19” flat panels, LaserJet printer, 3D Scanner(Instructor Use/Help only)	Raman

SECTION 7.10

Program Goals: *Each program shall have current short and long range goals, and plans for achieving these goals.*

Program Operation:

7.10 Program Goals: *Each program shall have current short and long range goals, and plans for achieving these goals.*

Short Term Goals:

1. We will hire a professional adviser for AST students.
   - The ITec program has a professional adviser that manages many of details of the program (handling program inquiries, orientation, distributing recruiting information, etc.). Currently there is no professional academic advisor working with the AST program. These duties are currently overseen by the professor-in-charge of the AST program, with assistance from a graduate student. Given faculty research and teaching demands, and the transitional nature of graduate students, a professional academic advisor dedicated to the AST program is need.
   - This position was endorsed by the ABE faculty in August of 2007 as a departmental priority. A position description has been written.
   - We are currently working to secure funds for this position.
2. We will hire a lecturer to assist in teaching industrial technology related courses.
   - In the past, the ITec program has used experienced graduate students to teach some of the courses. This practice provided adequate course delivery but the courses lacked consistency across years. Restructuring of the course offerings has minimized the need for non-faculty in instructional roles, but has not eliminated it. Specifically, there is need for instruction in TSM 310 (Total Quality Management) and TSM 340 (Advanced Automatic Manufacturing Processing).
   - The position was endorsed by the ABE faculty in August of 2007 as a departmental priority. As of the time of this report, we are writing the position description.
   - We are currently working to secure funds for this position.
3. Implement a distance-based certificate program in occupational safety.
   - The majority of safety professionals working industry do not have an educational background in occupational safety. These working professionals (from engineering, management, human resources, etc.) who now find themselves with safety management responsibilities are in need of professional development that documents this experience without requiring them to obtain a second undergraduate degree, The safety certificate can be earned concurrently with a undergraduate degree or can be earned by anyone who already has an undergraduate degree from an accredited institution of higher education. To make this program more attractive to working professionals, the courses in this program will be delivered via web-based technologies.
   - This program has been approved by the department, college, and university curriculum committees. The University Faculty Senate will vote on this program during the last full week in March.

Longer Term Goals:

1. Implement the Continuous Curricular Improvement Process.
   - With the merging of the Industrial Education and Technology department into the ABE department, we have spent much effort on restructuring the curricula, marshalling resources, and designing the continuous improvement process.

- We have a process that is being implemented, that is, we are collecting the data necessary to inform the continuous improvement process. We have not yet had the opportunity to implement the process, i.e., to collect enough data to make informed decisions and to "close the loop."
- The process we are implementing is parallel to the process used for the agricultural engineering (AE) program, another degree offered by the ABE department. A number of the faculty involved in the AE process are involved in the same process for the two technology programs. The AE program is approximately four years ahead of the technology programs in implementing the curricular improvement process. There is a wealth of experience that we can leverage to the technology programs.

2. New buildings for all ABE programs.

- We are in the midst of obtaining the support and funds necessary for two new buildings. These buildings will be part of a three-building complex to be built on the west side of campus. State funding has been approved for the first of the three buildings (a biorenewables laboratory, not an ABE building). The state Board of Regents has approved the building schematics. We have obtained, in concert with the ISU Foundation, nearly all of the $12.5 million of private funds we are required to raise for the buildings.
- We have not yet received state funding for our portion of the project. Although we are the number one building priority for Iowa State, the Board of Regents has not yet approached state government about funds.
- A likely scenario is that construction will begin in 2010, with occupancy in the fall of 2012.

3. Maintain and improve teaching laboratory equipment.

- A significant amount of equipment in our teaching laboratories need updating and/or replacing.
- The new buildings provide an opportunity to equip the new laboratories. We are aggressively raising private funds for this purpose with leadership from the ISU Foundation.
- The resource management budget model being implemented at ISU affords us with the ability to manage our funds differently. We will dedicate a portion of our resources for laboratory updates. It is unknown at this time what funds will be available, as we have yet to see how the new model will be implemented.

SECTION 7.11

Program/Option Operation: *Evidence shall be presented showing the adequacy of instruction including: (a) motivation and counseling of students; (b) scheduling of instruction; (c) quality of instruction; (d) observance of safety standards; (e) availability of resource materials; (f) teaching and measurement of competencies (specific measurable competencies shall be identified for each course along with the assessment measures used to determine student mastery of the competencies); (g) supervision of instruction; and (h) placement services available to graduates.*

A course syllabus shall be available for each course that appropriately describes course objectives, content, measurable competencies, references utilized, student activities and competency measurement criteria.

Program Operation:

7.11 Program/Option Operation: *Evidence shall be presented showing the adequacy of instruction including: (a) motivation and counseling of students; (b) scheduling of instruction; (c) quality of instruction; (d) observance of safety standards; (e) availability of resource materials; (f) teaching and measurement of competencies (specific measurable competencies shall be identified for each course along with the assessment measures used to determine student mastery of the competencies); (g) supervision of instruction; and (h) placement services available to graduates.*

A course syllabus shall be available for each course that appropriately describes course objectives, content, measurable competencies, references utilized, student activities and competency measurement criteria.

Motivation and Counseling of Students

Academic Advising

ABE advisors work with the student to develop an academic program that meets the student's career objectives as well as the requirements of the academic program in which the student is enrolled. The advisor acts as a resource person for university course offerings, programs, and procedures. It is the student's responsibility to be informed about the requirements for his or her degree and to ensure that these requirements are met. Academic advising is a shared set of responsibilities. Students are responsible for:

- knowing the degree requirements of their major and/or curriculum;
- planning schedules to meet their degree requirements;
- monitoring the accuracy of their degree audit; and
- knowing and conforming to university policies and procedures with respect to registration and schedule changes.

The academic advisor will:

- assist students in selecting courses for each semester;
- explore career opportunities with the student;
- work with the student to assess any transfer credits;
- monitor students' degree audit to help ensure that all graduation requirements are met;
- help students with other academic and personal concerns, referring them to other university support services when appropriate;
- explore with students out-of-class opportunities for leadership development.
- understand university policies and procedures; and
- be available during scheduled office hours and other times by appointment.

According to the Iowa State University Bulletin, Courses and Programs (General Catalog), ISU's academic advising program "promotes the student's development of competence, autonomy, and sound decision making skills." ABE advisors work with each student to develop an academic program that meets the student's career objectives as well as the requirements of the two technology programs.

When students first enroll in the department they are assigned to an academic advisor. Students are allowed to change their advisor at anytime, if they wish. Ordinarily, an AST student will remain with their assigned advisor until they choose an option, at which time they may wish to change to the advisor that specializes in that option. ITec students generally stay with the same academic advisor for their entire time in the program. Table 7.11.1 lists the faculty and staff who advise AST and ITec students.

Undergraduate advising of AST students has, over the past six years, been shared mainly by the teaching faculty. In 2006, Ms. Lequetia Ancar, co-coordinator of the Technology Learning Community, began advising freshman AST students.

Table 7.11.1. ABE Faculty and Staff who advise AST and ITec Students

Advisor	**Rank or position**
Ms. Lequetia Ancar	Academic Advisor
Dr. Carl J. Bern	University and Full Professor
Dr. Thomas Brumm	Associate Professor
Ms. Melody Carroll	Academic Advisor
Dr. Jay Harmon	Full Professor
Dr. Amy Kaleita	Assistant Professor
Dr. Jacek Koziel	Associate Professor
Dr. Charles Schwab	Full Professor

ABE advisors average about 20 advisees, which includes agricultural system technology (AST) students for some advisors. All industrial technology (ITec) undergraduates are advised by an advising coordinator (Melody Carroll) established prior to merging with ABE. A load of 40 advisees is considered a ¼-FTE teaching load.

Evaluation of advising by students in ABE began in the fall of 1999. Evaluation of ITec advising began using the same survey instrument in 2005. Evaluation is conducted in the spring semester before registration for the following academic terms. Table 7.11.2 lists the questions students are asked.

Table 7.11.2. Questions Asked in the Student Evaluation of Advising

<table>
<tr><th>Item</th><th>Question</th><th>Ranking</th></tr>
<tr><td>Knowledge</td><td>My advisor is well informed about rules, procedures, and course selection. If the answer isn't known, my advisor helps direct my question to appropriate resources.</td><td rowspan="7">5. Strongly agree
4. Agree
3. Neither agree or disagree
2. Disagree
1. Strongly disagree</td></tr>
<tr><td>Availability</td><td>My advisor is available through office hours, telephone, and email, or office appointments, if necessary</td></tr>
<tr><td>Reliable</td><td>My advisor keeps appointments when made. She/he follows through with efforts to determine answers to questions.</td></tr>
<tr><td>Approachable</td><td>My advisor encourages me to contact her/him. She/he expresses interest in me and shows concern for my problems and my progress in the program.</td></tr>
<tr><td>Advice</td><td>My advisor offers suggestions and evaluations. She/he informs me about university, community and professional resources. She/he helps me make contact or appointments when necessary.</td></tr>
<tr><td>Respect</td><td>My advisor treats me in a professional manner. She/he creates a supportive environment and discusses decision-making strategies. She/he gives full attention during my visit.</td></tr>
<tr><td>Career Guidance</td><td>My advisor provides adequate guidance relating to my career goals.</td></tr>
<tr><td>Overall</td><td>How would you rate your advisor’s overall effectiveness?</td><td>5. Excellent
4. Good
3. Fair
2. Poor
1. Un-satisfactory</td></tr>
<tr><td>Advisor Help</td><td>My advisor has helped me most by…</td><td rowspan="4">Open-ended response</td></tr>
<tr><td>Advisor Strength</td><td>One strength of my advisor is…</td></tr>
<tr><td>Suggestion for my advisor</td><td>One suggestion I would give to my advisor for the future would be..</td></tr>
<tr><td>Other comments</td><td>Additional comments about your advisor or the department's advising services in general…</td></tr>
</table>

Advisors receive their individual results at the end of the semester, along with departmental averages. Individual results are shared with the department chair for use in faculty/staff evaluation and development. The results for the past four years of student advising evaluations are given in Figure 7.11.1.

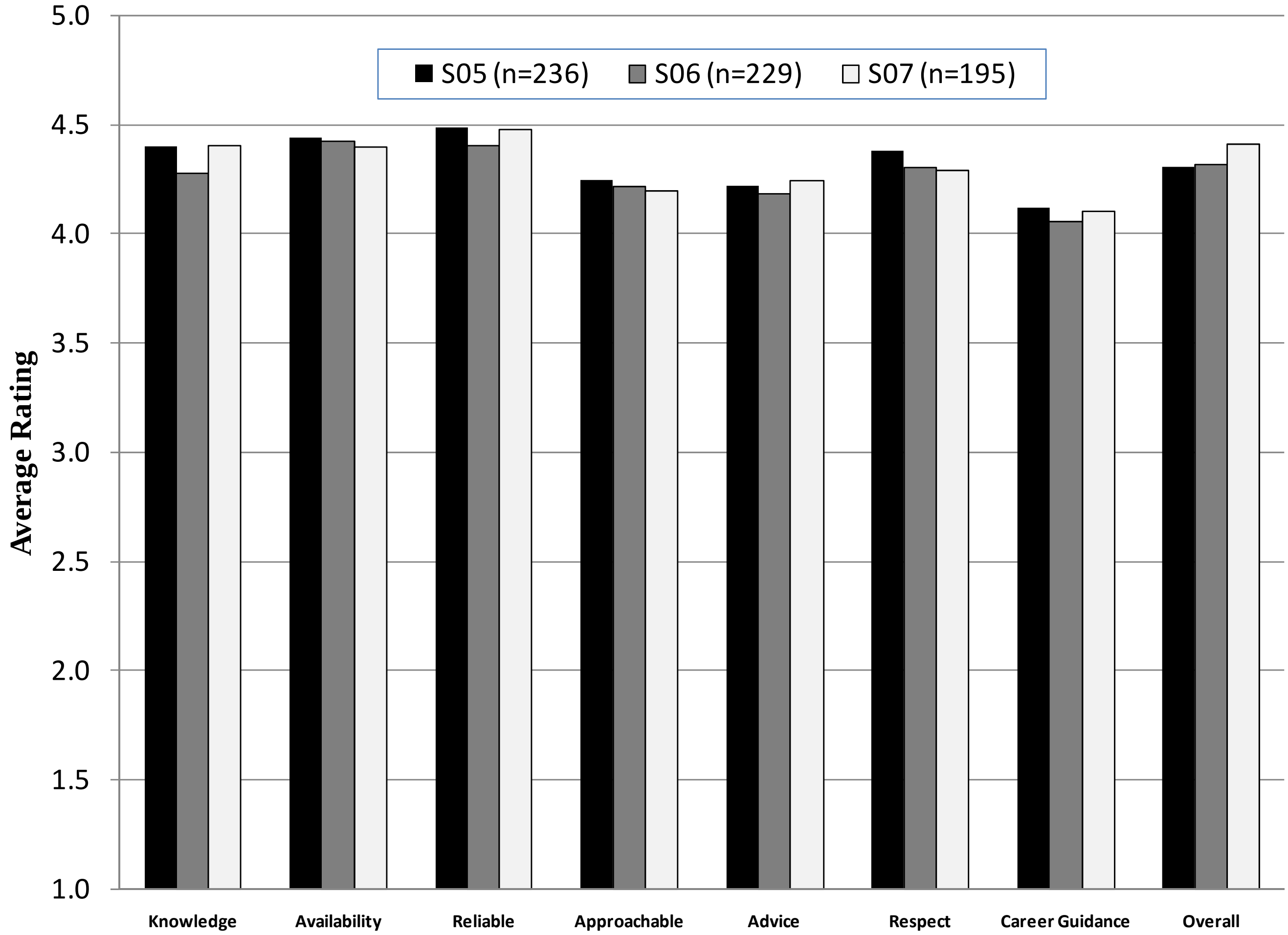

Figure 7.11.1. Results of Student Evaluations of Their Advisors

AST and ITec students are generally satisfied with the quality of advising they receive. However, improvements can be made, especially in the students' perception about "Knowledge" and "Advice," arguably key aspects of advising. While new faculty that just began advising affected the average ranking, we need to be vigilant in making sure advisors are familiar with the changing curricula and courses.

Advising improvement is discussed in two important forums. First, ABE advisors meet annually to discuss curriculum changes, course availability, the availability of advising resources, and, for new advisors, to receive training. Secondly, advising is regularly discussed during the ABE Learning Circle, a weekly informal meeting of ABE faculty, staff and graduate students. The ABE Learning Circle discusses issues relative to teaching, learning, assessment and advising.

Learning Community

The ABE department is one of the leaders in Learning Communities at Iowa State University, which is ranked in the top 5 nationally in this educational innovation. Learning communities are groups of students sharing a common schedule of introductory classes and/or living assignment. We've taken the basic learning community model and expanded it to include these characteristics:

- Contact with students who have similar academic goals
- Linked courses, where instructors collaborate on course content and delivery.
- An optional common place of residence
- Career exploration
- Introduction to university resources
- Peer mentoring and tutoring
- Faculty mentoring
- Simplified registration process (reduced course conflicts)
- Participation in department clubs and other organization
- Leadership development, especially for peer mentors
- Exposure to international and diversity issues
- Special programs to acquaint students with campus life
- More collaborative learning environment

All AST and ITec students participate in the academic portion of the learning community. The ABE department offers an optional living community opportunity for all ABE students (AE, AST and ITec programs). Freshmen and sophomore students may live together on a residence hall floor, half of which is reserved for ABE learning community students.

General goals for the ABE learning community initiative are:

- To build community for entering freshmen and sophomores within the three undergraduate curricula.
- To increase the retention of freshman and sophomore students in the three undergraduate curricula.
- To increase recruitment of students into the ABE programs, especially women and minorities.
- To use collaborative, learning-based educational methodology in the learning community courses to enhance learning and team skills.

Learning Community courses for AST and ITec freshman, sophomore, and junior students are shown in Table 7.11.3. Assessment of our learning community students has shown that we are achieving most of our goals. Students quickly become integrated into the ABE community. Retention rates (students who persist in our department as sophomores) have soared from 63% in 1998 when we started the ABE Learning Communities to nearly 95% in the fall of 2006.

Table 7.11.3. Technology Learning Community Common Courses.

Classification	Semester	Courses	Credit	Course Title
Freshman	Fall	TSM 110	1	Orientation to Technology
		Chem 163	4	General Chemistry
		Math 142	3	Trigonometry
		Econ 101	3	Principles of Microeconomics
	Spring	TSM 111	1	Experiencing Technology
		TSM 115	3	Solving Technical Problems
		Math 160	4	Survey of Calculus
Sophomore	Fall	TSM 210	3	Fundamentals of Technology
		Stat 104	3	Introduction to Statistics
	Spring	TSM 201	1	Internships and Entrepreneurship
		Engl 250	3	Composition II
Junior	Fall	TSM 363	4	Electricity for Agriculture and Industry
		Engl 314	3	Technical Writing (ABE only section)
	Spring	TSM 301	1	Ethics and Leadership
		Engl 314	3	Technical Writing (ABE only section)

Scheduling of Instruction

The procedure for scheduling classes allows input from students as well as the faculty. This participative approach provides both students and faculty some sense of ownership of the schedule of classes and a degree of control over their own schedules. This results in a high degree of satisfaction and cooperation among the students and faculty. Overlapping classes and scheduling conflicts are held to a minimum, so the accessibility of the course offerings to the students is high. This scheduling procedure ensures that students can complete the course requirements of departmental programs and the university consistent with their time expectations. The Departmental undergraduate advisors assist the students with preparing their schedules each semester to help ensure student success in a timely and appropriate fashion.

Course scheduling is coordinated by the Associate Department chair Dr. Steve Mickelson, who consults with faculty members concerning the schedule. Most required courses are offered each semester or at least once per year; some elective courses are offered in alternate semesters. Multiple sections of introductory courses (100 level courses) are sometimes necessary. Scheduled course offerings are coordinated to minimize course conflicts. Courses are scheduled between the hours of 8:00 a.m. and 9:00 p.m. on weekdays. Almost all courses are offered at least once each year. All the course offerings in Technology Systems Management are scheduled during fall and spring semesters.

The undergraduate advisors assist students in planning their academic programs and achieving success in their academic pursuits. Peer mentors provide informal support to students who participate in the Technology Learning Community. Freshmen are typically encouraged to take no more than 15 credits per semester while upperclassmen are advised to take class loads consistent with their abilities and prerequisites, time availability, and grade point averages. University policy states:

Each student has a credit limit for registration. For fall and spring semesters, this limit is 18 credits for undergraduate students. For summer session, the limit is 12 credits. Student must have their advisor’s approval to change the maximum credits allowed.

Most Technology Systems Management courses are three semester-hour offerings. A three-semester hour lecture class meets for three hours of classroom time each week. Three-semester hour laboratory classes involve one to two hours of lecture and two to six hours of laboratory time each week.

The scheduling of the activities within each class is the responsibility of the course instructor. The time devoted to lecture, discussion, recitation, and laboratory activities is organized to meet the educational objectives of the class within the available time. In most classes, laboratory assignments are planned to allow students to complete them within the regular laboratory schedule, since the required equipment in many courses is available only during those scheduled times.

Quality of Instruction

The Agricultural and Biosystems Engineering department has procedures for implementing the student evaluation of instruction (SEI) for the Technology Systems Management courses offered by our faculty and instructors. These student evaluations of instruction are required by department in the chair’s annual faculty evaluation materials and these evaluation are also reported the promotion and tenure materials. The feedback is used by the instructors to improve the teaching of future courses and by the department to monitor the overall teaching efforts.

Each semester all ABE Faculty and instructors are required to administer SEI for each section of course they teach. The Students complete the evaluation after the instructor leaves the classroom. A student volunteer handout SEI rubric sheet and answer bubble sheet and then collects the completed materials. The student volunteer returns those materials to the designated staff in each ABE building:

- Davidson - Sylvia Anderson
- Industrial Education II - Kris Bell
- National Swine Research and Information Center building - Barb Kalsem

The ABE department began in spring of 2007 with a new unified SEI and those are the results that are presented in this document. Prior years are available but not included in this self study report. The earlier

SEI reflects the many transitions from the merger and even the changes occurring from a transition caused by improving the original instrument used to gain student input. The SIE rubric sheet and SEI answer bubble sheet are in Appendix 7.11.

The ABE department's student evaluation of instruction for spring 2007 and fall 2007 are given in Table 7.11.4. The scale used for these evaluations are 0 as "unacceptable", 3 as "some success" and to 5 as "outstanding" and considered the top score.

Table 7.11.4. Reported Average Scores from Student Evaluation of Instruction for 2007

Questions	Average Scores	
	Spring 2007	Fall 2007
Clarity of intended student learning outcomes	4.01	3.90
Explanation of course content	4.02	3.83
Teaching methods	3.84	3.68
Applications of course content	4.01	3.86
Class participation	4.16	4.09
Relationship of assignments to expected student learning outcomes	4.03	3.88
Assignments helped meet expected student learning outcomes	3.86	3.78
Timeliness of feedback	3.76	3.79
Helpfulness of feedback	3.76	3.67
Grades to date reflect learning	3.84	3.66
Effectiveness of text and supplementary resources	3.59	3.45
Availability	4.02	3.98
Overall instructor effectiveness	3.95	3.84
Student effort	3.98	3.98
Overall student learning	3.87	3.73

Observance of Safety Standards

The safety of department students in our laboratory settings is dealt with in a multifaceted approach. The first approach is direct safety training and supervision. Students are not allowed to operate laboratory equipment until they have been trained on safety operating procedures and full understand the hazards associated with the equipment and/or processes. For example, in the introduction to manufacturing processes lab, the instructor reviews safety information and correct operating procedures with the students at the beginning of the semester. After this review, the students must pass a safety exam before they are allowed to use any of the equipment. In addition to the training on safety awareness and operating procedures, the department has strict policies on supervision in all departmental laboratories. Teaching labs are staffed by the instructor at all times. When it is deemed necessary to have more than supervisor to ensure a safe environment, the instructor will be assigned additional student help to assist. No students are allowed access to laboratory equipment without supervision during scheduled lab time, open lab time, or during make-up labs.

The second approach to providing a safe environment is provided in a variety of ways by departmental students themselves through our safety courses or through the ASSE student section. For example, students in TSM 272 Introduction to Occupational Safety and TSM 370 Occupational Safety have routinely conducted safety audits of our laboratory facilities and helped in identifying hazards as well as intervention methods. Student teams have developed lockout/tagout procedures for all equipment in the manufacturing labs even though these educational settings are exempt from the OSHA standard. As a class assignment, student teams have also been asked to identify hazards and recommend solutions for all aspects of educational environment. The results of these assignments are passed on to the department administration for prioritization action. This has resulted in upgrades such as increasing the illumination levels in the metals processing laboratory to installation of more ergonomic computer stations in departmental computer labs.

Availability of Resource Materials

Instructors of Technology Systems Management course use supplemental reference materials. These supplemental materials used include videotapes, DVDs, reference materials, periodicals, software, and Internet. Many of these materials are reflected in the course syllabi located in Appendix 7.11.

Examples of supplemental materials include:

TSM 210 Fundamental of Technology uses WebCT GOLD to provide access to syllabus, assignments, homework.

TSM 272 Introduction to Occupational Safety Technology uses WebCT GOLD to provide access to syllabus, assignments, homework. It also engages students in reflections on learning posting to WebCT GOLD.

TSM 276 Fire Protection and Prevention uses DVDs and VHS tapes for delivery of specialized message not otherwise available to students.

TSM 444 Facility Planning uses a variety of audio-visual components. Three videotapes introduce students to the concepts of Systematic Layout Planning. Factory design and modeling software is also used to help students understand design and layout of factories.

Contemporary computer software has an important role in many of the Technology Systems Management courses. The software packages available in the computer labs include; ArcView GIS, Autodesk Software (AutoCAD, Inventor, Mechanical Desktop, etc.), JMP Statistical, MatLAB, Microsoft Office 2007 Pro, Pro/Engineer and Pro/Mechanica, Solid Edge, SolidWorks, Staad Pro, and Visual Studio. The computer labs also have class specific software installed.

Teaching and Measurement of Competencies

<u>Relationship of Courses to Outcomes</u>

Table 7.11.5 shows how completion of TSM common courses (taken by all options) contributes to attainment of the program outcomes. Individual outcomes have from three to 16 courses or sequences supporting their attainment. These courses represent 61.5 of 125.5 required credits. Option, social science and humanities, biological and natural resource, and communication credits for the individual options contribute further to the attainment of program outcomes. Table 7.11.6 shows how the other TSM courses address the program outcomes.

Table 7.11.5 Relationship of Common TSM Courses to Program Outcomes

TSM common courses	Program Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
TSM 110 (Technology Orientation)				x		x	x		x	x	
TSM 111 (Experiencing Technology)	x	x		x			x			x	x
TSM 115 (Solving Technical Problems)	x				x		x				x
TSM 116 (Intro to Design in Technology)	x		x	x		x	x		x		x
TSM 201 (Internship and Entrepreneurship)						x	x	x	x	x	
TSM 210 (Fundamentals Technology)	x			x	x		x	x			x
TSM 270 (Injury Prevention)	x		x	x	x	x	x		x	x	x
TSM 301 (Ethics and Leadership)			x	x		x	x		x		
TSM 310 (Total Quality Management)	x		x	x	x	x	x		x		x
TSM 363 (Electric Power for Agriculture and Industry)	x	x	x		x	x	x				x
TSM 397, 399 (Internship)	x	x	x	x	x	x	x	x	x	x	x
TSM 401 (Senior Seminar)						x	x	x	x	x	x
TSM 415, 416 (Capstone I & II)	x	x	x	x	x	x	x	x	x	x	x
Chem 163 (General Chemistry)	x										
Chem 163L (General Chemistry Lab)		x		x			x				
Econ 101 (Intro to Microeconomics)											
English 150, 250 (Critical Thinking and Communication, Composition)				x			x	x			
Lib 160 (Library Instruction)							x		x		
Math 142, 160 (Trigonometry and Survey of Calculus)	x										
Phys 111 and 112 (Intro to Classical Physics I)	x	x		x			x				x
Stat 104 (Intro to Statistics)	x	x		x			x				x

Table 7.11.6 Relationship of Other TSM Courses to Program Outcomes

TSM common courses	Program Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
TSM 216 (Advanced Graphics)	**x**		**x**		**x**		**x**				**x**
TSM 240 (Intro to Manufacturing Processes)	**x**			**x**	**x**		**x**				**x**
TSM 272 (Intro to Occupational Safety)	**x**		**x**	**x**	**x**	**x**	**x**		**x**	**x**	**x**
TSM 276 (Fire Protection and Prevention)	**x**		**x**		**x**	**x**	**x**				**x**
TSM 322 (Preservation of Grain Quality)	**x**	**x**	**x**	**x**	**x**		**x**	**x**	**x**	**x**	**x**
TSM 324 (Soil and Water Conservation Management)	**x**		**x**		**x**	**x**	**x**			**x**	**x**
TSM 327 (Animal Production Systems)	**x**		**x**	**x**	**x**		**x**			**x**	**x**
TSM 330 (Ag Machinery and Power Management)	**x**	**x**	**x**	**x**	**x**		**x**				**x**
TSM 333 (Precision Farming Systems)	**x**	**x**	**x**			**x**		**x**	**x**		**x**
TSM 335 (Tractor Power)	**x**	**x**	**x**		**x**		**x**			**x**	
TSM 337 (Fluid Power Systems Technology)	**x**	**x**	**x**		**x**		**x**				**x**
TSM 340 (Advanced Automated Manufacturing Systems)	**x**		**x**		**x**		**x**				**x**
TSM 370 (Occupational Safety)	**x**		**x**	**x**	**x**	**x**	**x**	**x**		**x**	**x**
TSM 372 (Legal Aspects of Occupational Safety & Health)	**x**		**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
TSM 424 (Impacts of Agriculture on Water Quality)	**x**	**x**	**x**	**x**	**x**	**x**	**x**				**x**
TSM 433 (Advanced Precision Farming Systems)											
TSM 440 (Lean Manufacturing)	**x**	**x**	**x**	**x**	**x**		**x**		**x**		**x**
TSM 443 (Statics and Strength of Materials)	**x**	**x**	**x**		**x**						**x**
TSM 444 (Facility Planning)	**x**		**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
TSM 465 (Automation Systems)	**x**	**x**	**x**	**x**	**x**		**x**				**x**
TSM 470 (Industrial Hygiene)	**x**	**x**	**x**		**x**	**x**	**x**			**x**	**x**
TSM 471 (Safety Laboratory)	**x**	**x**	**x**	**x**	**x**	**x**	**x**				**x**
TSM 477 (System Safety Analysis)	**x**	**x**	**x**	**x**	**x**	**x**	**x**				**x**

<u>Measurement of Competencies</u>

Student achievements of program outcomes are determined by directly measuring competency demonstration in two settings:

1. Supervisor evaluation of students in internships.
2. Faculty evaluation of student work in their electronic portfolios.

At this time, we do not yet have data from the 2nd setting. We are just now requiring all ITec and AST students to start building portfolios that demonstrate the competencies. We have, however, been collecting data from ITec and AST students on internships since the Fall of 2006. The results of these assessments are listed in Table 7.11.7. Most of the students' competencies were ranked at 4.0 or above, meaning they often perform the Key Actions when given the opportunity. The only two exceptions were Communication and Innovation. A more useful way of looking at these results is by comparing the relative ranking (1 through 15) of the competencies. This is given in Table 7.11.8.

The lowest ranked Competencies are the ones we will target for improvement.

Achievement of Student Learning Outcomes

We compare the achievement of learning outcomes to the "perfect" achievement of the learning outcomes with the following formula.

$$\% \text{ Achievement} = \frac{\sum (competency\ ranking)(weighting\ \ factor)}{\sum (5)(weighting\ \ factor)} \times 100\%$$

We have these targets:

1. Students should attain at least an 80% achievement of each Outcome as measured by their demonstration of workplace competencies in internships.
2. Students should attain at least an 80% achievement of each Outcome as measured by their demonstration of workplace competencies in their portfolios.

Figure 7.11.2 shows the achievement of student learning outcomes by AST and ITec students, as determined by supervisors (direct measurement) and student self-assessment (indirect measurement) in an internship setting. Students have achieved the target for achievement of each Outcome.

We have improvements to make in collecting and analyzing this data. The major improvement addresses the fact that the data so far has been collected without regard to program or option. In the future, we will collect data segregated in this fashion.

Supervision of Instruction

The Agricultural and Biosystems Engineering Department has had an established practice of assessing instruction for over 100 years. Currently the department encourages instructors to seek peer evaluation of courses being taught. This peer evaluation is used to strengthen the course and to document the faculty teaching abilities during the promotion and tenure process. The Associate Department Chair also monitors the faculty and instructors performance in the classroom with individual student evaluations of instruction during each semester. Adjustment in assignments can be made accordingly by the Associate Department Chair. The student evaluations of instruction will now be shared with the departmental technology curriculum committee chair.

Table 7.11.7 Results of Competency Assessment in ITec and AST Internships: F06 through SS07 (n=121)

Competency	Self	Supervisor	Ranking Criteria
Analysis and Judgment	4.24	4.23	*When given the opportunity, how often do you (or does the student) perform the Key Actions associated with each of the competencies?* 1. Never or almost never. 2. Seldom. 3. Sometimes. 4. Often. 5. Always or almost always. NA No opportunity or not applicable (not included in calculation of average ranking)
Communication	4.13	3.98	
Continuous Learning	4.28	4.19	
Cultural Adaptability	4.21	4.23	
Customer Focus	4.20	4.16	
Engineering Knowledge	4.32	4.17	
General Knowledge	4.34	4.18	
Initiative	4.22	4.15	
Innovation	4.07	3.90	
Integrity	4.63	4.73	
Planning	4.24	4.25	
Professional Impact	4.37	4.23	
Quality Orientation	4.41	4.40	
Safety Awareness	4.27	4.44	
Teamwork	4.33	4.24	

Table 7.11.8 The Top Five and Bottom Five Results of Competency Assessment in ITec and AST Internships: F06 through SS07 (n=121)

Student Self-Assessment		Supervisor Assessment
	Top Five	
Teamwork	1	Integrity
Safety Awareness	2	Safety Awareness
Quality Orientation	3	Quality Orientation
Professional Impact	4	Planning
Planning	5	Teamwork
	Bottom Five	
Customer Focus	11	Engineering Knowledge
Cultural Adaptability	12	Customer Focus
Continuous Learning	13	Initiative
Communication	14	Communication
Analysis and Judgment	15	Innovation

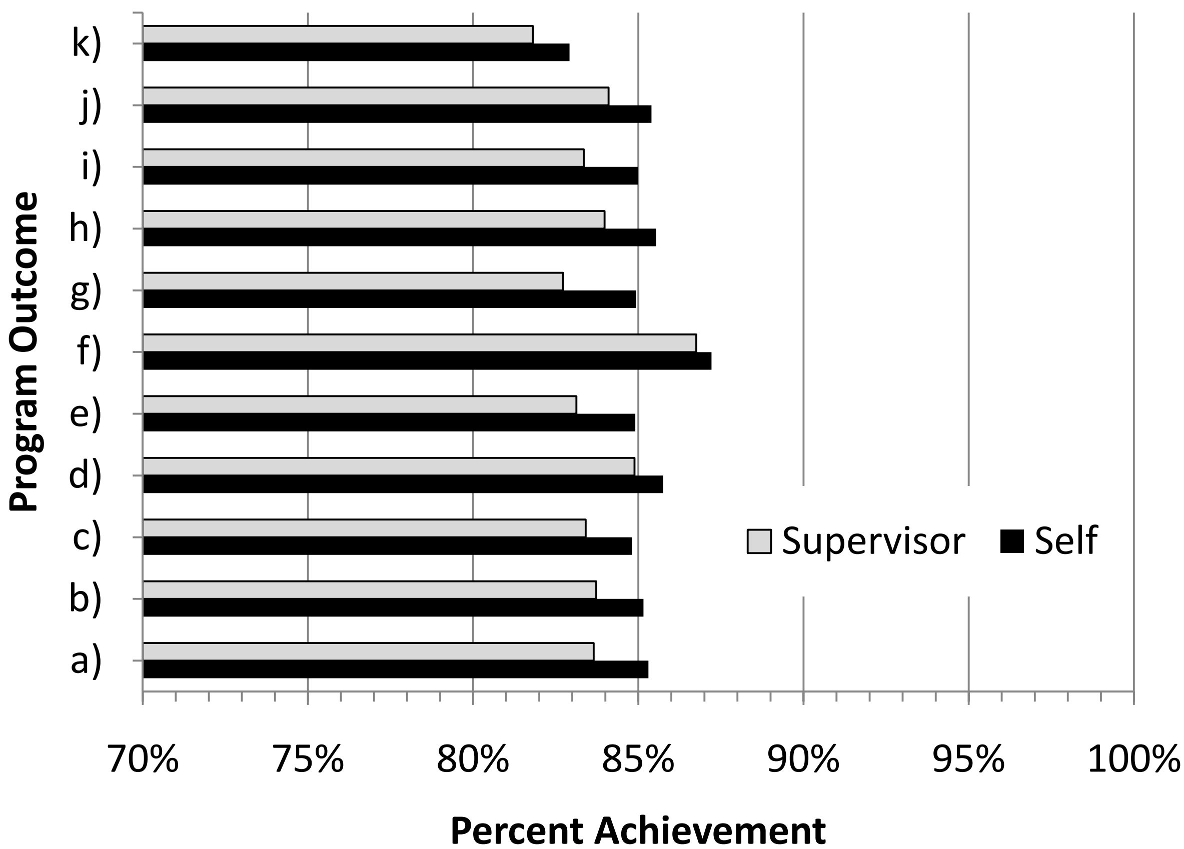

Figure 7.11.2. Achievement of Student Learning Outcomes as Determined by Supervisors

For instructors and Faculty, Iowa State University offers support to improve instruction through the Center for Excellence in Learning and teaching (CELT). The center for the enhancement of learning and teaching was first established by the Iowa State University Faculty Senate in 1993. Various teaching related seminars are sponsored by CELT. Currently, Dr. Steve Freeman has a shared appointment with the center as the Assistant Director and a faculty member in the ABE department.

Placement Services Available to Graduates

Iowa State University provides career services offices in each college. Each office serves students and alumni in identifying experiential learning assignments and permanent career employment. Both Industrial Technology and Agriculture System Technology students use the placement services of the College of Agriculture and Life Sciences under the direction Mr. Mike Gaul.

<u>Services Offered to ABE Technology Students</u>

All Industrial Technology and Agriculture Systems Technology undergraduates are encouraged to register with ISU Agriculture and Life Sciences Career Services. The following services are available to Industrial Technology students through Agriculture and Life Sciences Career Services:

- Registration
- Résumé referral
- Job Vacancies: Bulletin and Hotline Computer Access
- Résumé and cover letter critiques
- On-campus interviews

- Mock interviews
- Workshops on résumés/cover letters, interviewing, job search, etc.
- Presentations to clubs and organizations
- Ag. Career Day

Relationships with Employers

Agriculture and Life Sciences Career Services has developed and nurtured strategic relationships with industrial and employer partners. Activities include periodic internal and external review meetings, training, and ongoing communications regarding the partnering process. Students can take advantage of trips, project activities, and industrial contacts offered by the partners.

The Department maintains close relationships with the supportive employers represented on the External Advisory Council. Members include department alumni and employers interested in hiring our graduates. Announcements of additional job opportunities come directly to the Department and are posted on departmental bulletin boards and e-mail lists.

SECTION 7.12

Student Satisfaction with Program/Option: *Student evaluations of the program/option shall be made at the time of graduation. These evaluations shall include student attitudes related to the importance of the general outcomes and specific competencies identified for the program/option. Summary data shall be available for student evaluations of the program/option.*

Outcome Measures:

7.12 Student Satisfaction with Program/Option: *Student evaluations of the program/option shall be made at the time of graduation. These evaluations shall include student attitudes related to the importance of the general outcomes and specific competencies identified for the program/option. Summary data shall be available for student evaluations of the program/option.*

The technology student evaluations from 2002 to 2007 reflect considerable changes mainly as the result of the departmental merging becoming official in the fall of 2004 and the first University catalog reflecting the merged Technology programs' curricula and Technology Systems Management courses being printed in fall 2007. The spring and fall semesters of 2007 are the first times where all students were participating in unified evaluation process for the university, department, and program outcomes. The student evaluation summary presented in this section will use only the 2007 data. Student evaluations data for the all years (2002, 2003, 2004, 2005, 2006 and 2007) along with data collection instruments are available in Appendix 7.12.

The Industrial Technology and Agricultural Systems Technology students at the time of graduation are given several opportunities to provide evaluation and comments about their educational experience at Iowa State University, their degree program/option, and self evaluation of how he or she met each of the program outcomes. The students complete an ABE Graduating Senior Questionnaire, General Evaluation of ABE/ISU Experience bubble sheet survey, and can participate in a Senior Exit Luncheon. A summary of these evaluations are provided by degree program.

Industrial Technology Student Satisfaction

A total of 43 Industrial Technology students at the time of graduation participated in the General Evaluation of ABE/ISU Experience bubble sheet survey. There were 25 students in the spring and 18 in the fall. These students responded that their overall experience in the department was between very good and excellent with an average score of 4.3 spring 2007 and 4.1 fall 2007 on a scale of 1 to 5 with 5 being top score. The top area of student satisfaction was with the departmental advising that obtained an average score of 4.5 spring 2007 with the lowest standard deviation. The low scoring student satisfaction areas were related to teaching and laboratory facilities and equipment in the facilities. The average score for these areas ranged from 2.5 to 2.7 with high standard deviations. Table 7.12.1 shows all the average scores and standard deviations for all departmental areas for both semesters.

Industrial Technology students rated their satisfaction with the required university courses outside the department (see Table 7.12.2). These received a rating between average and very good with an average scoring range from 3.1 to 3.9 on a scale of 1 to 5 with 5 being top score.

On the same survey, the Industrial Technology students were asked to self assess how well they perceived that they met each of the Agricultural and Biosystems Engineering program outcomes. The average self assessment score for the 11 outcomes are provided in Table 7.12.3. Scoring Scale for these outcomes were: 1- Not at all, 2-Somewhat, 3-Adequately, 4-Above Average, and 5 Extremely Well. The average for students' scores ranged from a low of 3.7 for "Knowledge of contemporary issues" in Fall of 2007 to a high of 4.5 for "Understanding of professional and ethical responsibility" in Fall of 2007. These students believe that clearly have adequately met the ABE outcomes with a strong indication they were above average in most of these program outcomes.

Agricultural Systems Technology Student Satisfaction

A total of 18 Agricultural Systems Technology students at the time of graduation participated in the General Evaluation of ABE/ISU Experience bubble sheet survey. There were 10 students in the spring and 8 in the fall. These students responded that their overall experience in the department was above average in spring 2007 with an average score of 3.9 on a scale of 1 to 5 with 5 being top score. Their overall experience in the department was between very good and excellent in the fall 2007 with an average score of 4.4. The top area of student satisfaction was with their internship/co-op experience that obtained an average score of 4.8 with the lowest standard deviation. The low scoring student satisfaction areas were related to

Table 7.12.1 Industrial Technology Students Satisfaction with Departmental Elements of the Program Spring 2007 and Fall 2007

Descriptions	Spring 2007		Fall 2007	
	Average	STD DEV	Average	STD DEV
Overall, my experience in the department was	4.3	0.74	4.1	0.73
Department teaching on the whole was	3.9	0.73	3.6	0.62
Department advising on the whole was	4.5	0.65	4.1	1.11
Department lecture facilities were	2.7	0.90	2.6	0.86
Department laboratory facilities were	2.6	1.11	2.5	1.15
Department teaching laboratory equipment was	2.7	0.80	2.6	0.92
Department computer laboratories were	2.7	1.06	3.2	1.10
The support I received from ABE Faculty was	4.0	0.74	3.8	0.86
My learning community experience was	3.8	0.77	2.8	1.25
The courses taught within the department were	3.7	0.68	3.7	0.59
My internship/co-op experience was	3.9	1.36	4.4	0.71
My ABE student club experience(s) were	3.9	0.83	3.5	1.13

Satisfaction Scale: 1- poor, 2-fair, 3-average, 4-very good, and 5 Excellent.

Table 7.12.2 Industrial Technology Students Satisfaction with University Elements of the Program Spring 2007 and Fall 2007

Descriptions	Spring 2007		Fall 2007	
	Average	STD DEV	Average	STD DEV
ISU course taught in mathematics were	3.1	0.57	3.3	0.91
ISU course taught in chemistry were	3.1	0.93	3.3	0.77
ISU course taught in physics were	3.1	0.99	3.1	1.00
ISU course taught in English were	3.9	0.57	3.3	0.91
My US Diversity course was	3.7	0.48	3.4	0.99
My International Perspectives course was	3.6	0.79	4.4	0.71
Placement Services within the College were	3.6	0.74	3.7	1.03

Satisfaction Scale: 1- poor, 2-fair, 3-average, 4-very good, and 5 Excellent.

Table 7.12.3 Industrial Technology Students Average Self Assessment Scores for 11 Outcomes for Spring 2007 and Fall 2007

Descriptions	Spring 2007		Fall 2007	
	Average	STD DEV	Average	STD DEV
Ability to apply knowledge of Mathematics, science and engineering/technology	4.0	0.68	3.8	0.64
Ability to design and conduct experiments, as well as to analyze and interpret data	3.9	0.76	4.1	0.80
Ability to function on multi-disciplinary teams	4.2	0.71	4.4	0.62
Ability to identify, formulate, and solve engineering/technology problems	4.0	0.61	4.1	0.68
Understanding of professional and ethical responsibility	4.1	0.60	4.5	0.62
Ability to communicate effectively	4.0	0.58	4.2	0.65
Recognition of the need for, and an ability to engage in, life-long learning	4.1	0.57	4.1	0.83
Knowledge of contemporary issues	4.1	0.60	3.7	0.90
Ability to use the techniques, skills, and modern engineering/technology tools necessary for engineering /technology practice	4.1	0.64	3.9	0.73
Broad education necessary to understand the impact of engineering/technology solutions in a global, economic, environmental, and societal context	4.0	0.71	3.8	0.73
Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	4.0	0.68	4.2	0.79

Scoring Scale: 1- Not at all, 2-Somewhat, 3-Adequately, 4-Above Average, and 5 Extremely Well.

teaching and laboratory facilities and equipment in the facilities. The average score for these areas ranged from 2.5 to 3.2 with high standard deviations. Table 7.12.4 shows all the average scores and standard deviations for all departmental areas for both semesters.

Agricultural Systems Technology students rated their satisfaction with the required university courses outside the department (see Table 7.12.5). These received a rating above fair but below very good with an average scoring range from 2.4 to 3.9 on a scale of 1 to 5 with 5 being top score.

On the same survey, the Agricultural Systems Technology students were asked to self assess how well they perceived that they met each of the Agricultural and Biosystems Engineering program outcomes. The average self assessment score for the 11 outcomes are provided in Table 7.12.6. Scoring Scale for these outcomes were: 1- Not at all, 2-Somewhat, 3-Adequately, 4-Above Average, and 5 Extremely Well. The average for students' scores ranged from a low of 3.6 for "Knowledge of contemporary issues" in spring of 2007 to a high of 4.4 for "Ability to communicate effectively" in Fall of 2007. These students believe that

Table 7.12.4 Agricultural Systems Technology Students Satisfaction with Departmental Elements of the Program Spring 2007 and Fall 2007

Descriptions	Spring 2007		Fall 2007	
	Average	STD DEV	Average	STD DEV
Overall, my experience in the department was	3.9	0.57	4.4	0.52
Department teaching on the whole was	3.6	0.52	3.9	0.64
Department advising on the whole was	3.9	1.20	3.3	1.17
Department lecture facilities were	2.9	0.74	2.9	1.13
Department laboratory facilities were	3.3	0.82	2.9	1.13
Department teaching laboratory equipment was	3.2	0.79	2.9	0.84
Department computer laboratories were	4.0	0.94	3.8	1.29
The support I received from ABE Faculty was	4.4	0.70	4.1	0.84
My learning community experience was	3.7	1.16	4.1	0.70
The courses taught within the department were	3.6	0.84	4.0	0.76
My internship/co-op experience was	4.4	0.79	4.8	0.45
My ABE student club experience(s) were	4.1	1.22	4.5	0.55

Satisfaction Scale: 1- poor, 2-fair, 3-average, 4-very good, and 5 Excellent.

Table 7.12.5 Agricultural Systems Technology Students Satisfaction with University Elements of the Program Spring 2007 and Fall 2007

Descriptions	Spring 2007		Fall 2007	
	Average	STD DEV	Average	STD DEV
ISU course taught in mathematics were	3.1	0.84	2.4	1.19
ISU course taught in chemistry were	3.1	0.57	2.8	0.89
ISU course taught in physics were	3.1	0.93	3.4	0.79
ISU course taught in English were	3.9	0.99	3.3	1.17
My US Diversity course was	3.7	0.57	2.6	1.19
My International Perspectives course was	3.6	0.48	2.6	0.92
Placement Services within the College were	3.6	0.74	3.7	1.38

Satisfaction Scale: 1- poor, 2-fair, 3-average, 4-very good, and 5 Excellent.

Table 7.12.6 Agricultural Systems Technology Students Average Self Assessment Scores for the 11 Outcomes for Spring 2007 and Fall 2007

Descriptions	Spring 2007		Fall 2007	
	Average	STD DEV	Average	STD DEV
Ability to apply knowledge of Mathematics, science and engineering/technology	4.0	0.47	4.0	0.82
Ability to design and conduct experiments, as well as to analyze and interpret data	3.7	0.68	3.8	0.71
Ability to function on multi-disciplinary teams	4.4	0.52	3.8	0.89
Ability to identify, formulate, and solve engineering/technology problems	4.2	0.42	3.6	0.74
Understanding of professional and ethical responsibility	4.4	0.52	4.0	0.93
Ability to communicate effectively	4.3	0.68	4.4	0.74
Recognition of the need for, and an ability to engage in, life-long learning	4.3	0.68	4.1	0.99
Knowledge of contemporary issues	3.6	1.08	4.1	0.99
Ability to use the techniques, skills, and modern engineering/technology tools necessary for engineering /technology practice	4.1	0.32	4.0	0.76
Broad education necessary to understand the impact of engineering/technology solutions in a global, economic, environmental, and societal context	4.0	0.67	4.0	0.76
Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	4.1	0.74	4.0	0.76

Scoring Scale: 1- Not at all, 2-Somewhat, 3-Adequately, 4-Above Average, and 5 Extremely Well

clearly have adequately met the ABE outcomes with a strong indication they were slightly above average in most of these program outcomes.

Student Satisfaction with Courses, Department, Faculty, and Programs

Both the Industrial Technology students and the Agricultural Systems Technology students at the time of graduation participated in the ABE Graduating Senior Questionnaire and the Senior Exit Luncheon session. Those responses were not divided by degree program in this self study report. The primary the focus was assessing the courses taught by the department, the faculty teaching those courses, and the club opportunities that exist in the department for the students so the degree program identity was not a priority. The Senior Exit Luncheon session is less formal reporting method so the actual statements were not identified by the students' degree program. The complete data from these assessments tools are located in Appendix 7.12.

The top 15 most valuable Agricultural and Biosystems Engineering Technology Systems Management courses identified by students in 2007 were:

1. TSM 440 Cellular Lean Manufacturing Systems (25 votes)
2. TSM 444 Facility Planning (20 votes)
3. TSM 477 System Safety Analysis (9 votes)
4. TSM 472 Industrial Hygiene: Physical, Chemical, and Biological Hazards (4 votes)
5. TSM 465 Automation Systems (3 votes)
6. TSM 416 Technology Capstone II (3 votes)
7. TSM 322 Preservation of Grain Quality (3 votes)
8. TSM 415 Technology Capstone I (2 votes)
9. TSM 210 Fundamentals of Technology (2 votes)
10. TSM 240 Introduction to Manufacturing Processes (1 vote)
11. TSM 272 Introduction to Occupational Safety (1 vote)
12. TSM 324 Soil and Water Conservation Management (1 vote)
13. TSM 327 Animal Production Systems (1 vote)
14. TSM 330 Agricultural Machinery and Power Management (1 vote)
15. TSM 373 Legal Aspects of Occupational Safety and Health (1 vote)

The top 15 least valuable Agricultural and Biosystems Engineering Technology Systems Management courses identified by students in 2007 were:

1. TSM 310 Total Quality Improvement (14 votes)
2. TSM 270 Principles of Injury Prevention (11 votes)
3. TSM 370 Occupational Safety (10 votes)
4. TSM 363 Electric Power and Electronics for Agriculture and Industry (6 votes)
5. TSM 401 Professionalism Seminar (6 votes)
6. TSM 110 Introduction to Technology (5 votes)
7. TSM 415 Technology Capstone I (4 votes)
8. TSM 416 Technology Capstone II (4 votes)
9. TSM 465 Automation Systems (3 votes)
10. TSM 401 Professionalism Seminar (2 votes)
11. TSM 327 Animal Production Systems (2 votes)
12. TSM 301 Leadership and Ethics Seminar (2 votes)
13. TSM 444 Facility Planning (1 vote)
14. TSM 337 Fluid Power Systems Technology (1 vote)
15. TSM 340 Advanced Automated Manufacturing Processes (1 vote)

The top 5 most valuable Technology Systems Management courses outside the Agricultural and Biosystems Engineering department identified by students in 2007 were:

1. Engl 314 Technical Communication (12)

2. Acct 284 Financial Accounting (4 votes)
3. Mgmt 370 Management of Organizations (4 votes)
4. Agron 212 Crop Growth, Productivity and Management (4 votes)
5. SpCm 212 Fundamentals of Public Speaking (3 votes)

The top 5 least valuable Technology Systems Management courses outside the Agricultural and Biosystems Engineering department identified by students in 2007 were:

1. ComSt 101 Introduction to Communication Studies (10 votes)
2. Acct 284 Financial Accounting (6 votes)
3. Mgmt 471 Personnel and Human Resource Management (5 votes)
4. Agron 212 Crop Growth, Productivity and Management (4 votes)
5. SpCm 212 Fundamentals of Public Speaking (4 votes)
6. Lib 160 Library Instruction (4 votes)

The opportunities the Agricultural and Biosystems Engineering department and Iowa State University provided to develop and practice leadership skills, both in the curriculum and in extracurricular actives identified by students in 2007 were:

1. Student clubs (25 votes)
2. Group Projects/ Team Work (13 votes)
3. Group Projects (12 votes)
4. Some of Valuable Coursework (6 votes)
5. Internships (5 votes)
6. Jobs (5 votes)
7. Peer Mentoring (5 votes)
8. Student club Activities: Fountain Wars, Robotics Team, etc (4 votes)
9. Internship (4 votes)
10. Teachers-student interaction (2 votes)

Nearly half of the student participating in the survey are active or participate in some of the Agricultural and Biosystems Engineering student clubs.

The top five “Greatest strengths/competencies for professional career” as identified by student in 2007 were:

1. Communication skills (18 votes)
2. Teamwork (10 votes)
3. Leadership (9 votes)
4. Problem Solving (6 votes)
5. Experience (6 votes)

The top five “weakest strength/ competencies for professional career” as identified by student in 2007 were:

1. Communication skills (7 votes)
2. Cultural Adaptability (5 votes)

3. Technical Knowledge (3 votes)
4. Organization (3 votes)
5. Innovation (3 votes)

The top five “most important knowledge, skill, or ability that gained due to experiences at Iowa State University” as identified by students in 2007 were:

1. Technical Knowledge (9 votes)
2. Communication Skills (8 votes)
3. Leadership (8 votes)
4. Group Work/Team Work (8 votes)
5. Problem solving (5 votes)

The top five suggestions of “one thing to improve experience as a student at Iowa State University” as identified by students in 2007 were:

1. Be a member of a club or organization or get more involved (8 votes)
2. Start in the I TEC major from day one (7 votes)
3. Get involved (5 votes)
4. Taken different or more classes (4 votes)
5. Paid better attention in class (3 votes)

The student also offered individual comments that are shared in Appendix 7.12 but only some examples of those are given here divided into two groupings.

Positive comments about department, faculty and programs

> “The department makes you feel part of the community with staff & student interaction, encouraging & wanting everyone to have succeeded. I feel proud to be a grad from this department & the tools I learned here will make me successful no matter what path my life goes. “
>
> “The AST program is a great program for students to take. It gives everyone a chance to do what they want to do. “
>
> “I think that the faculty us great at working with the students and I would like to thank them for being great teachers. “
>
> “Good program, recommends it to people.”
>
> “Awesome department! Thank You!”
>
> Dr. Brumm is the best thing that happened to the ABE department
>
> “Do not let Dr. Chen go.”
>
> “TSM 440/444; Chen is a great teacher, an asset”
>
> “Melody Carroll is an awesome advisor”
>
> “Shahan is doing a great job; he is approachable and available”

Constructive observations about department, faculty and programs

> “Faculty Advisors – too busy and not aware of policies and procedures”
>
> “Update Computer Systems and workspace”

“Get rid of Mgmt 471, Physics 111”

“A few of the AST classes were taught by professors who didn’t’ know much about the subject. AST 330.”

“Some of the lower level classes are too simple and some of the upper level courses should be worth more credit.”

“Portfolios are not effective for safety students.”

“Split up TSM 440, fist semester for KAISER and second semester for the industry project.”

“Make sure professors at the lower levels are helpful and well spoken as these classes are the foundations for the major. Improving these classes will also help with retention and recruitment.”

“Professors should be involved in classes and with students; respect the students’ efforts and time.”

“Manufacturing majors should not have to take safety classes. There should be more manufacturing classes. Some of the classes could be split up.”

“Wright’s TSM 270-too basic”

“Make Computer labs available and open more. Hours?”

“Start portfolio earlier”

“What can safety option students do in regards to their portfolio?”

“Portfolios a waste of time; executive summary”

“TSM 401- professional Development Financing: just review and is boring. Couldn’t see video. Technical difficulty”

“Teach how to be better organized”

“TSM 115: waste of time, basic, boring”

“Lack of free electives, students wants more”

“I Tec: Needs more safety advertisement”

SECTION 7.13

Initial Employment of Graduates: *The initial placement, job titles, job descriptions and salaries of graduates shall be tracked on an annual basis. The initial jobs held by students shall be consistent with program/option goals. Summary data shall be available for the initial employment of graduates.*

7.13 Initial Employment of Graduates: *The initial placement, job titles, job descriptions and salaries of graduates shall be tracked on an annual basis. The initial jobs held by students shall be consistent with program/option goals. Summary data shall be available for the initial employment of graduates.*

The initial jobs held by Industrial Technology and Agricultural Systems Technology graduates are consistent with the respective program goals. The evidence of initial placement, job titles, and salaries are provided below for both the Industrial Technology and Agricultural Systems Technology programs.

Industrial Technology Graduates

The ABE department had 96% of the 331 Industrial Technology graduates over this period of time respond to surveys about their employment. The six year average placement for the 318 student responding was 96.2%. About two thirds of the graduates find placement within Iowa. Overall, 5% went on to graduate school. Placement data for the Industrial Technology graduates by year is shown in Table 7.13.1.

Table 7.13.1 Placement Data for Industrial Technology Graduates for FY2002-FY2007

Time Period	# Grads	# Survey Respondents	Total Employed	Employed in Iowa	Employed out of Iowa	Further Education	% Placed	Seeking	Not Seeking	No Information
2001-2002	45	42	37	23	14	3	95.2	1	1	-
2002-3003	48	45	42	28	14	2	97.8	1	-	-
2003-2004	66	59	50	37	13	1	86.4	8	-	-
2004-2005	56	56	54	36	18	1	98.2	1	-	-
2005-2006	68	68	64	44	20	4	100	-	-	-
2006-2007	48	48	43	24	19	5	100	-	-	-

* Data from these years are collected from the College of Education Placement Service.
Data is collected from the College of Agricultural and a Life Sciences Placement Service.

The indentified employers and job titles for the Industrial Technology graduates over this period of time respond are listed in Table 7.13.2 and 7.13.3 respectively. Representative examples of actual job descriptions for jobs accepted by Industrial Technology graduates are provided in appendix 7.13. A complete listings of all job descriptions is not available but additional actual descriptions are available upon request.

The ABE department had 41% of the 331 Industrial Technology graduates over this period of time respond to salary surveys. Starting salaries ranged from $25,000 to $75,000, with an average of $43,641 for the 6 year period. Salary data for Industrial Technology graduates by year is shown in Table 7.13.4.

Table 7.13.2 Employer Data Listed in Alphabetical Order for Industrial Technology Graduates for FY2002-FY2007

3M	Electrolux Home Products	Kraft Foods Inc.	Romech
A. M. Cohron & Son	EMCO Inc.	Kuhn Knight North America	ROTC
A.G. Tebbe Farms Inc.	Engineered Production	Lenox Industries	Rubbermaid
ACCU-Steel Cover Building	Equipment, Inc	Local #1 Ironworkers	Sandhills Tile & Stone
Acumold	ENTGEE	Lockheed Martin	Sandvik Coromant
Adam Aircraft	Entgee	LoPrex	Sargent Metal Fabrication
AFG Glass	Esco Energy Services	L'Oreal USA	Sauer-Danfoss
Ag Leader Technology	ESCO Group	M.A. Ford Mfg Co., Inc.	Schillinger Seed
AGCO Corporation	Eshelman Trenching	MA Mortenson Company	Scott Farms
Ahern Fire Protection	Excel Trailers	Mary Greeley Medical Center	Scott Forge Technology, Inc.
AJ Frank - Ingersoll	Family Business	Maytag Corp	Senecca Foundary
All Steel	Family farm	McKiness Excavating	Servi-Tech
Allied Insurance	Farmers Cooperative	Meade Electric Co	Shelby Co Soil Cons District
Almaco	Firestone	Medical Industries America	Silver Engineering
Alpla	Firestone Ag Tire	Mellman's	Smith Feed and Fertilizer
Altec Industries, Inc.	Fisher Controls	Metal Design Systems	Southern Staircase
Amana Refrigeration	Fivestar Industries	MidAmerican Energy Co.	Speciality Archery
American Packaging Corp.	Fjeldberg Lutheran Church	Midwest Industries	Square D
Anderson Corporation	Flatiron Const. Corp.	Midwest Manufacturing	Structural Component
Architectural Wall System	Flatiron United	Military Branch	Systems
Area Erectors	Flenker Ent	Miller Mechanical Specialties	STS Manufacturing, Inc.
ASI Cover Buildings Inc.	Fox Valley Stair Co.	Modine Manufacturing	Summit Polymers, Inc
Associated Spring/Barnes Inc	Frutown Construction	Moellers Pork	Sutter
Attachment Technologies, Inc	Garst/Syngenta	Motorola	Switf & Company
Augusta Aviation	General Contractor	Murphy Brown	Sysco Company
B G Brecke, Inc.	Genesis System Group	Nestle' Purina	Tech Staff
Belean	Gits Manufacturing	New Century FS	The Kiewit Building Group
Berkey Home Builder	GK Machine	New Millenium Tech	The Navigators
Blue Cube LCD	Gomaco	Newell-Rubbermaid	The Weitz Company
Boeing	Goodrich	Newton Valve	Titan Tire
Boltz	Graham Millwork	NHI	Tolomatic
Bunge	Hadar Manufacturing	Nohill Technologies	Tony's Tire Service
Campus Bookstore	Halliburton	Northstar Fire Protection	Townsend Engineering
Captive Plastics	Hawkeye	Old Castle Materials	Twin Oaks Stock Farms, Ltd.
Carver Pump Co	Hearth & Home Technologies	Oriental Trading Company	Two Rivers Glass & Door
Case-New Holland	Hearth Technologies	Paragon, International	Tyson/IBP Inc
Caterpillar, Inc	Heartland Pork Ent.	Paul Steelman Design Group	Union Pacific Railroad
CEMEX USA	HNI Corp.	Peace Corp	United Parcel Service
Centeral Iowa Bldg.S& F	HNI/Allsteel	Pella Windows	United States Air Force
CitiBank	HON Industries	Pepsi Co.	United States Army
City of Ankeny	Hormel	Performance Pipe	United States Marine Corps
CLAAS of Omaha	Hultgren Implement, Inc.	Phillips Modern Ag	United States Navy
CNH America	(Deere)	Pinnacle Group	US Compliance Corp
Collins & Aikman	IAMU Iowa Association of	Pioneer	US FZRG Protection
Collusion	Municipal Utilities	Plews/Edelmann	USDA
Cooper	IBP	Plum Building Systems	USDA NVSL
Cottonville Farms	Innovative Lighting	Polaris Industries	VanGorp Corp
Countrywide Grain Terminal	Interconnect Devices Inc.	Power Engineering & Mfg	Vermeer Manufacturing
Croell Concrete	Iowa Association of	Powermation	Viracon
Daul Steelman Design Group	Municipal Utilities	Precision Inc	VT Industries
DC Taylor Construction	Iowa National Guard	Progressive Insurance	Wausau Insurance Company
DE Smith	Iowa Spring	Proplanner	Weitz Construction
DeeZee Inc.	Iowa Thin Films	Pyramid Inc.	Weitz Industrial
Dial Corporation	J&J Enterprises	Quality Manufacturing Corp	Westendorf Manufacturing
Diamond Crystal Brands	JELD-WEN, Inc.	Radio Shack	Weyerhaeuser Company
Duggan & Associates	Jet Company	Rayloc	Winnebago Industries
Duro Electric Inc	John Deere	Residential Steel Fabricators	Woodland Farms
Dyncorp	Johnson & Johnson	Rock Island Arsenal	
Eaton Corp	Kiewit Building Group	Rockwell Collins	

Data from these years are collected from the College of Education and the College of Agricultural and a Life Sciences Placement Services. Employers' identification is not duplicated in this listing.

Table 7.13.3 Job Title Data Listed in Alphabetical Order for Industrial Technology Graduates for FY2002-FY2007

2nd Lieutenant	General Manager	Quality Engineer
2nd Shift Manager	Grain Elevator Manager Trainee	Quality Tech/Resource Spec
Agronomy Technician	Group Manager	Quality/Production Mgr
Aircraft Maintenance Officer -	Hog manager	RCI Engineer
Flight Commander	Industrial Engineer	Research Assistant
AMS Specialist / CSR	Industrial Hyg	Research Tech III
Application/Industrial Eng	Industrial process engineer	Resource Specialist
Applications, Engineer	Inspector	Safety
Area Crop Specialist	Junior Associate	Safety & Training Mgmt
Associate Manufacturing	Laborer	Safety Coordinator
Engineer	Language Specialist	Safety Engineer I
Asst Production Manager	Language specialist / Study Abroad	Safety Manager
Asst Safety Coordinator	Office (Pearson Hall)	Safety Officer
Asst Safety Manager	Lean engineer	Safety Specialist
CAD Designer	Loss control rep	Safety Supervisor
Cell Leader	Loss Prevention Consultant	Safety Tech
Client Support Group	Maintenance Supervisor	Sales
Code Enforcement Officer /	Management	Sales & Marketing Trainee
Combination Inspector	Management Assistant	Security Clerk
Continuous Improvement	Management Trainee	Security Specialist /Iraq
Coordinator	Manager	Service Trainer
Corn/soybean producer	Manager of Yard Operations	Shop Manager
Crop Specialist	Manufacturing Engineer	Supervisor
Custom applicator	Manufacturing Manager	Support technician
Design Engineer	Manufacturing Process Engineer	Surface Warfare Officer
Design/Project engineer	Manufacturing sales rep	Sys Sup Spec III (Extension)
Designer	Manufacturing/Component	System Support Tech
Designer/Architect	Engineer	TA and Lab Monitor
Door Plant Safety Coordinator	MBA	Technical machine sales
Drafting	Mechanical Associate	Technical Sales
Drafting and Quality Control	Mechanical Engineer	Technical Sales Associate
EHS Advisor	Mgmt Training Program	Technical service and support trainee
Engineer	Navigator	Technical Support
Engineer Associate	Occupation Safety	Technical Support Specialist
Engineering Analyst	Pharmaceuticals Sales Rep	Technology Support
Engineering Technician	Precision Ag Specialist	Union Ironworker
Entry Level	Process Engineer	USAF Pilot
Environmental Health and Safety	Process Supervisor	Warranty & Reliability Analyst II
Engineer	Product Configuration	
Equipment operator	Product Design Engineer	
EWP Technician	Product Release	
Farm Assistant	Professional in Development	
Field Associate Engineer	Project Coordinator	
Field Engineer	Project Engineer	
Field Safety Supervisor	Project Manager	
Field Tech	Project Operator	
Field Technology Engineer	Quality Assurance management	
Field Test Technician	Trainee	
Foreman	Quality Assurance Technician	

Data from these years are collected from the College of Education and the College of Agricultural and a Life Sciences Placement Services. Job titles are not duplicated in this listing.

Table 7.13.4 Salary Data of Industrial Technology Graduates for FY2002-FY2007

Time Period	**# Graduates**	**# Salaries Reported**	**Low**	**Average**	**High**
2001-2002*	45	19	$26,000	$42,105	$54,000
2002-3003*	48	23	$25,000	$40,642	$55,000
2003-2004*	66	21	$30,000	$39,782	$51,000
2004-2005	56	24	$30,000	$42,215	$60,000
2005-2006	68	31	$32,500	$46,506	$55,000
2006-2007	48	17	$40,000	$50,970	$75,000

* Data from these years are collected from the College of Education Placement Service.
Data is collected from the College of Agricultural and a Life Sciences Placement Service.

Agricultural Systems Technology Graduates

The ABE department had 99.5% of the 211 Agricultural Systems Technology graduates over this period of time respond to surveys about their employment. The six year average placement for the 210 student responding was 99 %. Overall, 4% went on to graduate school. About three quarters of the graduates found placement within Iowa. Placement data for the Agricultural Systems Technology graduates by year is shown in Table 7.13.5.

The indentified employers and job titles for the Agricultural Systems Technology graduates over this period of time respond are listed in Table 7.13.6 and 7.13.7 respectively. Data for job titles for Agricultural Systems Technology graduates are not available and not included. Representative examples of actual job descriptions for jobs accepted by Industrial Technology graduates are provided in appendix 7.13. A complete listings of all job descriptions is not available but additional actual descriptions are available upon request.

Starting salaries ranged from $20,000 to $57,000, with an average of $36,417 for the 6 year period. Salary data for Agricultural Systems Technology graduates is shown in Table 7.13.8

Table 7.13.5 Placement Data for Agricultural Systems Technology Graduates for FY2002-FY2007

Time Period	# Grads	# Survey Respondents	Total Employed	Employed in Iowa	Employed out of Iowa	Further Education	% Placed	Seeking	Not Seeking	No Information
2001-2002	33	33	30	21	9	3	100	-	-	-
2002-3003	45	45	43	29	14	1	97.8	1	-	-
2003-2004	22	22	22	16	6	-	100	-	-	-
2004-2005	42	42	40	34	6	2	100	-	-	-
2005-2006	40	40	40	32	8	-	100	-	-	-
2006-2007	29	28	24	20	4	3	96.4	1	-	1

Data is collected from the College of Agricultural and a Life Sciences Placement Service.

Table 7.13.6 Employer Data Listed in Alphabetical Order for Agricultural Systems Technology Graduates for FY2002-FY2007

A & I Equipment	ICS L.L.C.	Self-employed
Adecco	Iowa Department of Ag Land Stewardship	Servi-Tech
ADM	Iowa Railroad Historical Society	Shelby Co Soil Cons District
ADM, Grain Division	Iowa Select Farms	Smith Feed & Fertilizer
AFG Coatings	Iowa Soybean Association	Stip Bros. Inc.
Ag Leader Technology	Iowa State University	Stoecker Farms
AGCO Corporation	John Deere	Superior Deshler
AGP	John Deere AMS	Swiss Valley Ag Service
Agriliance	John Deere Commercial Credit Union	Syngenta Seeds Inc.
Ajinomoto Heartland Inc.	John Deere Credit	Titan Machinery
Almaco	John Deere Des Moines Works	Twin Anchors Golf Course
Almon Studios	John Deere Product Development Center	Union Pacific Railroad
Apex Environmental Inc.	John Deere Worldwide Combines	University of Minnesota
Archer Daniels Midland	Junge Control Inc.	Unverferth MFG.
Audio Labs	Kemin Industries	US Air Force
Blue Cube LCD	Kinze Manufacturing	USDA
Bunge North America	KMR	USDA FSA
Cargill	Kraft Oscar Meyer	USDA NRCS
Cargill Crop Nutrition	Kuehl & Payer Ltd.	USDA NSTL
Cargill Excel	Kuhn Knight North America	USDA Plant Introduction Station
Cargill Meat Solutions	Land O'Lakes Purina Feed	Validus Servicers LLC
Cartersville Elevator Inc.	Mason City Red Power	Van Wall Group
Case-New Holland	Mazimum Ag	Vermeer Manufacturing
Christensen Family Farms	McKim Tractor Service	Volt Services
City of Ankeny	McKiness Excavating	Western Iowa Coop
City State Bank	Miami University	Westfalia Surge
CNH	Midwest Utilities	Woodland Farms
CNH America LLC, Test Lab	Milk Products Inc.	Ziegler Caterpillar
ConAgra	Miller Mechanical Specialties	Zylstra Harley Davidson
Cottonville Farms	Moellers Pork	
Dairyland Seed	Monsanto Company	
DK Farms	Murphy Brown	
Ecolotree	Nestle Purina PetCare	
Elanco Animal Health	New Century FS	
Exelon	Novariant AutoFarm	
Family farm	Pinnacle Food Group	
Farmers Coop Society	Pinnacle Group	
Farmers Cooperative Company	Pioneer Hi-Bred	
First National Bank	Progressive Insurance	
FJ Krob & Company	Purina	
Flenker Ent	River Valley Coop	
Garst	Ryerson Implement	
Garst/Syngenta	Sansgaard Seed Farms Inc.	
Hagerty Lawn Care & Construction	Schillinger Seed	
Heartland Agri Supply		
Hokel Machine Supply		
Horizon Equipment		
Hultgren Implement, Inc. (Deere)		

Data from these years are collected from the College of Agricultural and a Life Sciences Placement Services. Employers' identification is not duplicated in this listing.

Table 7.13.7 Job Title Data Listed in Alphabetical Order for Agricultural Systems Technology Graduates for FY2002-FY2007

Ag Trainee	Management Assistant
Agronomist	Management Trainee
Agronomy Technician	Mechanical Associate
AMS Specialist	Plant Supervisor
AMS Specialist / CSR	Precision Ag Specialist
Area Crop Specialist	Product Specialist
Client Support Group	Quality Assurance
Code Enforcement Officer / Combination Inspector	Reliability & Warranty Analyst II
	Research Assistant
Corn/Soybean Producer	Research Tech III
Crops Specialist	Safety Associate
Custom Applicator	Sales
Design Engineer	Sales & Marketing Trainee
Elevator Management Trainee	Seed / Agronomy Sales
Engineering Technician	Service Rep
Farm Manager	Service Trainer
Field Marketer	Soybean Research Tech
Field Tech	Support Technician
Field Test Technician	Team Leader
Hog Manager	Tech Support Agent
Installation Technician	Technical Service And Support Trainee
Laborer	Technical Support
Loan Officer	Technical Support Specialist

Data from these years are collected from the College of Agricultural and a Life Sciences Placement Services. Job titles are not duplicated in this listing.

Table 7.13.8 Salary Data of Agricultural Systems Technology Graduates for FY2002-FY2007

Time Period	**# Graduates**	**# Salaries Reported**	**Low**	**Average**	**High**
2001-2002	33	9	$20,000	$29,999	$39,000
2002-3003	45	21	$23,000	$36,727	$55,000
2003-2004	22	10	$28,000	$37,354	$57,000
2004-2005	42	19	$28,000	$34,805	$48,500
2005-2006	40	16	$28,000	$37,906	$55,000
2006-2007	29	12	$32,000	$41,708	$48,000

Data is collected from the College of Agricultural and a Life Sciences Placement Service.

SECTION 7.14

Job Advancement of Graduates: *The advancement of graduates within organizations shall be tracked on a regular basis (two to five years) to ensure promotion to positions of increasing responsibility. Summary data shall be available for the job advancement of graduates.*

7.14 Job Advancement of Graduates: *The advancement of graduates within organizations shall be tracked on a regular basis (two to five years) to ensure promotion to positions of increasing responsibility. Summary data shall be available for the job advancement of graduates.*

The Department has conducted Alumni of Industrial Technology Follow-up Studies for many years and has done so most recently in 2004. Alumni for the last six years were (1998-2003) surveyed. These alumni are asked questions concerning the importance of curricular components and questions about their career advancement. In the spring of 2004, 67 former industrial technology students responded to the alumni survey. The results of this 2004 alumni study are discussed below.

Table 7.14.1 shows alumni responses concerning the importance of general curricular components. Sixty-six alumni responded to these questions. For the questions on "Perceived Importance" the following scale was used: Essential (5): Important (4); Neither important or unimportant (3); Relatively unimportant (2); Clearly unimportant (1). For the questions on "Quality of Preparation" the following scale was used: Outstanding (5): Good (4); Adequate (3); Poor (2); No preparation (1).

Table 7.14.1 Ratings of General Topics Required of all Industrial Technology Students

		Perceived Importance		**Quality of Preparation**	
General Topic	**Rank**	**Mean**	**S.D.**	**Mean**	**S.D.**
Using computers	1	4.90	0.43	4.36	0.74
Oral communication	2	4.82	0.39	3.88	0.81
Written communications	3	4.71	0.49	4.00	0.76
Internship/coop	4	4.64	0.72	4.32	0.80
Manufacturing processes	5	4.62	0.63	4.14	0.77
Team building	6	4.56	0.73	4.16	0.72
Organizing and using professional materials	7	4.52	0.66	3.70	0.81
Industrial management	8	4.50	0.59	3.75	0.88
Safety in manufacturing	9	4.48	0.64	4.19	0.69
Human relations	10	4.48	0.69	3.76	0.78
Quality assurance	11	4.39	0.80	3.83	0.77
Total quality management	12	4.39	0.70	3.89	0.84
Industrial organization	13	4.39	0.65	3.83	0.75
Locating and soliciting job related materials	14	4.27	0.88	3.61	1.00
Design/CAD	15	4.22	1.01	4.37	0.73
Appreciate individual and group differences	16	4.17	0.97	3.88	0.72
Material properties	17	4.12	0.79	3.72	0.98
Statistics	18	4.06	0.82	3.58	0.94
Material testing[3]	19	4.00	0.86	3.84	0.89
Research and development	20	3.98	0.92	3.47	0.89
Electricity/electronics	21	3.95	0.95	4.00	0.82
Introduction to training & development	22	3.86	0.96	3.70	0.81
Hazardous material handling	23	3.61	1.02	3.53	0.96
Physics	24	3.55	1.05	3.57	0.76
Psychology	25	3.02	1.17	3.33	0.71
Chemistry	26	2.98	1.04	3.45	0.69
Calculus	27	2.77	1.21	3.37	0.89

Table 7.14.2 shows alumni responses concerning the importance of occupational safety curricular components. Forty alumni responded to these questions. For the questions on "Perceived Importance" the

following scale was used: Essential (5): Important (4); Neither important or unimportant (3); Relatively unimportant (2); Clearly unimportant (1). For the questions on “Quality of Preparation” the following scale was used: Outstanding (5): Good (4); Adequate (3); Poor (2); No preparation (1).

Table 7.14.2 Ratings of Occupational Safety Topics

2004 Alumni Survey		Perceived Importance		Quality of Preparation	
Occupational Safety Topic	**Rank**	**Mean**	**S.D.**	**Mean**	**S.D.**
Safety training	1	4.46	0.68	4.06	0.92
Hazard recognition/analysis	2	4.38	0.81	3.97	0.88
Ergonomics	3	4.33	0.73	4.11	0.89
Fire safety	4	4.28	0.76	4.00	1.04
Industrial hygiene – bio. & chem.. hazards	5	4.13	0.86	3.81	0.98
Legal issues	6	4.10	0.94	3.51	1.27
Safety administration/management	7	4.08	0.98	3.77	1.09
Accident investigation	8	4.05	1.00	3.69	1.14
First Aid/CPR	9	4.03	0.87	3.61	1.27
Construction safety	10	3.95	1.05	3.84	1.09
Industrial hygiene - physical hazards	11	3.89	0.74	3.44	0.82
Physiology and anatomy	12	3.44	1.27	3.33	1.39
Organic chemistry	13	3.38	1.23	3.25	1.40

Table 7.14.3 shows alumni responses concerning the importance of manufacturing technology curricular components. Sixty alumni responded to these questions. For the questions on “Perceived Importance” the following scale was used: Essential (5): Important (4); Neither important or unimportant (3); Relatively unimportant (2); Clearly unimportant (1). For the questions on “Quality of Preparation” the following scale was used: Outstanding (5): Good (4); Adequate (3); Poor (2); No preparation (1).

Table 7.14.3 Ratings of Manufacturing Technology Topics (2004 Alumni Survey)

Manufacturing Technology Topic	Rank	Perceived Importance		Quality of Preparation	
		Mean	**S.D.**	**Mean**	**S.D.**
Production control	1	4.44	0.82	3.64	0.94
Facility planning	2	4.42	0.79	4.00	0.84
Lean and agile systems design	3	4.37	0.83	3.75	1.04
Cost estimating and accounting	4	4.36	0.80	3.47	0.97
Industrial electronics	5	4.17	0.79	3.95	0.95
Kaizen technique5	6	4.16	1.06	4.10	0.93
Computer-aided manufacturing	7	4.08	1.01	4.10	0.73
Fluid systems - hydraulics and pneumatics	8	4.07	0.97	3.79	1.10
Computer-aided design in 3D3	9	4.07	1.01	4.17	0.76
Programmable logic controls	10	4.05	0.89	3.83	0.98
Using community resources	11	4.02	0.90	3.24	1.18
Computer-numerically controlled program.	12	3.98	1.03	4.03	0.88
Digital electronics	13	3.83	0.98	3.73	0.99
Statics	14	3.83	0.94	3.60	1.14
Robotics	15	3.78	1.04	3.60	1.14
Polymer and composite processing	16	3.67	0.97	4.00	0.84
Visual basic programming 5	17	3.34	1.12	3.15	1.30

These alumni were also asked questions concerning professional advancement. Twenty alumni indicated that they had already been promoted. Table 7.14.4 shows alumni responses concerning professional advancement.

Table 7.14.4 Measures of Professional Advancement (2004 Alumni Survey)

Certification/ Licenses		Obtaining Advanced Degrees		Promotion from Previous Job	
N	**%**	**N**	**%**	**Yes**	**No**
9	13.4%	3	4.5%	20	29

Alumni were asked to classify their current position within their company. Figure 7.14.1 shows classification of current position by graduation year.

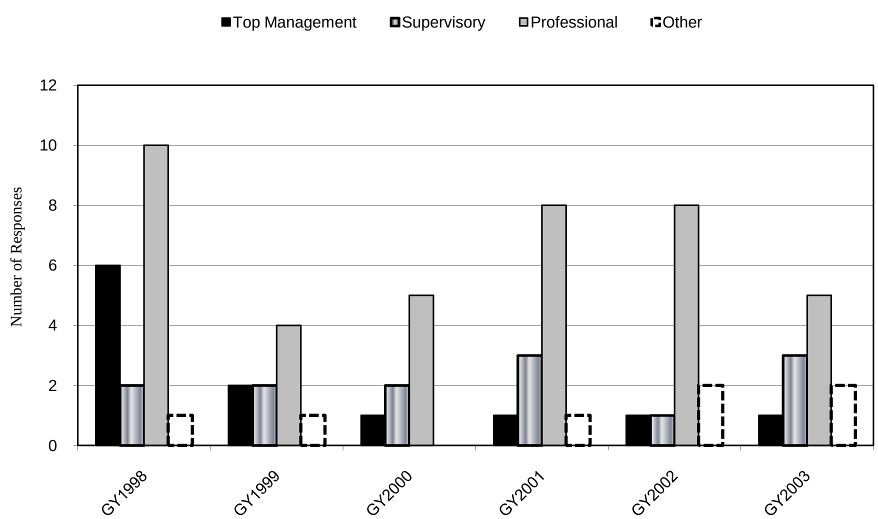

Figure 7.14.1 Classification of Current Position by Year of Graduation

Alumni were asked classify who directs work in their current position. Figure 7.14.2 shows who directs the work within their current position.

Alumni were also asked questions concerning the value that their undergraduate degree in regards to their career advancement and their perception of the overall quality of their industrial technology degree. The results to these questions are shown in Table 7.14.5. Finally, 61 of 66 alumni indicated that they would recommend the Industrial Technology Program at ISU to others.

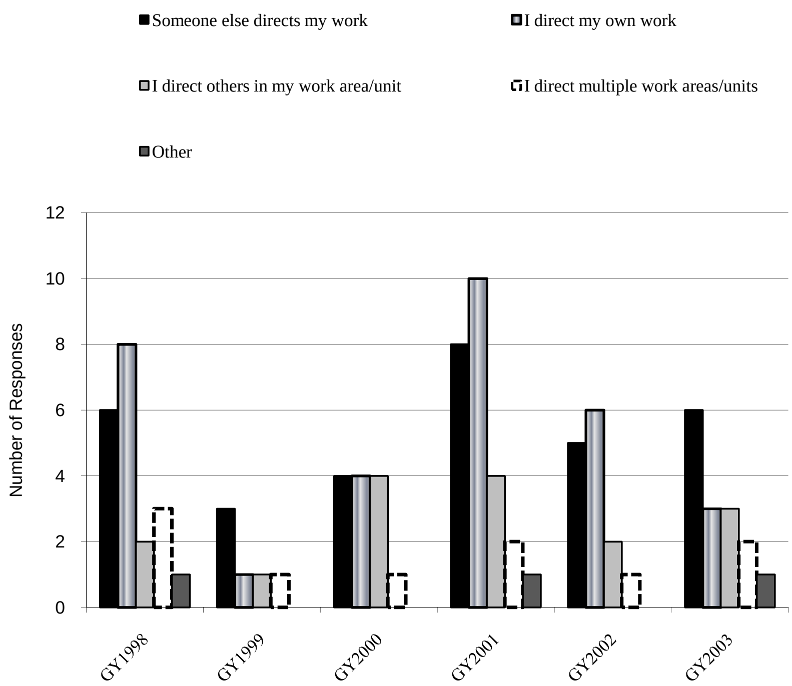

Figure 7.14.2 Classification of Who Directs Work by Year of Graduation

As detailed elsewhere in this report, the Department is currently in the process of changing our assessment procedures to focus on student outcomes and competencies. We have already validated these competencies with department faculty and our industrial advisory council. We have plans in the future to use the same assessment paradigm directly with alumni. Thus, the next Alumni Follow-up Study will look much different from the questions we have asked in the past. We will however continue to ask alumni specific questions about career advancement. We have plans for moving this assessment process to a web-based format to make it more convenient for alumni to respond. The next alumni survey will also include alumni of the Agricultural Systems Technology Program.

Table 7.14.5 Overall Summary Questions from the 2004 Alumni Survey

Question	N	Mean	S.D.
To what extent do you think that your degree from Industrial Education and Technology was a factor in your appointment to, or advancement in, your present position? *Scale: 5 = Essential factor, 4 = Important factor, 3 = Somewhat a factor, 2 = Minor factor, 1 = Not a factor*	67	3.40	1.09
To what extent do you feel that your undergraduate degree was relevant to your present job? *Scale: 5 = Essential, 4 = Important, 3 = Neither unimportant or important, 2 = Relatively unimportant, 1 = Clearly unimportant*	67	3.73	1.11
How would you rate the overall program in Industrial Education and Technology at the time you graduated? *Scale: 5 = Excellent, 4 = Good, 3 = Fair, 2 = Poor, 1 = Unacceptable*	67	3.97	0.76

SECTION 7.15

Employer Satisfaction with Job Performance: *Employer satisfaction with the job performance of graduates shall be tracked on a regular basis (two to five years) including employer attitudes related to the importance of the specific competencies identified for the program. Summary data shall be available showing employer satisfaction with the job performance of graduates.*

7.15 Employer Satisfaction with Job Performance: *Employer satisfaction with the job performance of graduates shall be tracked on a regular basis (two to five years) including employer attitudes related to the importance of the specific competencies identified for the program. Summary data shall be available showing employer satisfaction with the job performance of graduates.*

The Department has conducted Employers of Industrial Technology Graduates Follow-up Studies for many years and has done so most recently in 2004. The first step in the process was to contact alumni and ask them for the name and contact information of their immediate supervisor. In the spring of 2004, alumni were contacted. From this pool, 41 provided the name and contact information of their supervisor giving the department permission to contact them. Of the 41, supervisors who received the survey requesting information from them concerning the graduates' preparation for his or her job, 17 completed and returned the survey. The results of this 2004 study are shown in Table 7.15.1. Supervisors of industrial technology graduates were asked to rate the graduate's preparation in 16 different content areas. The following scale was used for the 2004 survey: Poor (1); Adequate (2); Good (3); Outstanding (4).

Table 7.15.1. Results of the 2004 Employers of Graduates Follow-up Study.

Topic	**(N=17)**	
	Mean	**St.Dev**
Computer Skills and Application	3.71	0.47
Overall Technical Knowledge of Manufacturing	3.07	0.59
Drafting, Design, and CAD	3.33	0.90
Mathematics (Trigonometry, Calculus, Statistics)	3.13	0.92
Overall Knowledge of Occupational Safety	3.00	0.52
Communications (Oral, Written, Listening)	3.35	0.70
Manufacturing Processes	2.93	0.70
Overall Knowledge of Training and Development	3.18	0.81
Principles of Management	2.94	0.75
Automation and Systems	2.85	0.56
Properties of Materials and Testing	2.79	0.70
Electronics (General, Industrial, Digital)	2.47	0.74
Fundamentals of Economics and Accounting	2.73	0.70
Social Sciences (Humanities, Sociology, Psychology)	2.94	0.75
Physical Sciences (Physics, Chemistry, etc.)	2.93	0.73

Overall computer skills ranked as the graduates' highest skills. The department's emphasis on communication skills has paid off with this skill now ranking 2nd up from 7th in the 2001 employer survey. At this time, electronics still is rated as their weakest area of preparation, which is consistent with what other sources of data indicated. It is important to note that only one employer rated one graduate as "poor" and on only one competency.

The following are comments that employers reported on the 2004 Employers of Graduates Follow-up study. A copy of the survey instrument can be found in Appendix 7.15. As part of this study, open-ended questions were asked of employers. The following are examples of responses:

- Very organized, timely, hard working, insightful students, eager to learn real-world activities.
- <Name> is a great guy to work with. He is a team player who works well with others to accomplish objectives. <Name> has excellent technical skills and is willing to use them to do what the job requires.
- <Name’s> strengths are in his leadership and communication skills.
- We are a “lean” manufacturing company, which made it really important that <Name> had gained knowledge of “lean” as part of her education. She has been very active in lean events and is one of our lean champions. <Name> is also extremely dependable with an excellent work ethic.
- Ability to communicate from CEO to floor personnel. Willingness to take on projects.
- <Name> is personable, self-motivated, organized, and eager to please. He is willing to take calculated risks to improve production methods. His knowledge of lean manufacturing and quality was critical to attaining his position at our company.
- None (areas for improvement) really. <Name> did an internship with us while he was at ISU. The internship really helped prepare him for full-time employment here.
- <Name> has strong skill sets in manufacturing and I expect him to continue to be a significant contributor to our success.
- Keep churning people like <Name> out. Iowa needs “him”.
- <Name> worked for me during breaks and holidays which really helped her gain practical experience. She started work permanently at our company with very solid footing. Education plus experience is the best combination for students.
- <Name> has worked out very well. We had ~150 resumes for his position. I’m sure that we hired the best candidate out of the 150 applicants. I would certainly hire him again if I had it to do over.

As detailed elsewhere in this report, the Department is currently in the process of changing our assessment procedures to focus on student outcomes and competencies. We have already validated these competencies with department faculty and our industrial advisory council (who represent our graduate’s employers). We have plans in the future to use the same assessment paradigm directly with employers of our students. Thus, the next Employer of Graduates Follow-up Study will look much different from the questions we have asked in the past. We also continue to struggle to get alumni to provide us with their supervisor contact information and then with getting supervisors to respond. We have plans for moving this assessment process to a web-based format to make it more convenient for both alumni and their supervisors to respond.

SECTION 7.16

Student Success in Advanced Program: *If a goal of the program/option is to prepare students for advanced studies, then the success of students in the advanced study programs shall be tracked and confirmed. Summary data shall be available showing student success in advanced programs.*

7.16 Student Success in Advanced Program: *If a goal of the program/option is to prepare students for advanced studies, then the success of students in the advanced study programs shall be tracked and confirmed. Summary data shall be available showing student success in advanced programs.*

Preparing industrial technology students for graduate programs is not a primary goal of the program. However, success in graduate education can be considered a secondary indicator of the quality and success of the undergraduate industrial technology program. During this accreditation cycle, 11 industrial technology undergraduates have entered the department’s graduate programs. These students are presented here as evidence that our undergraduate industrial technology students can be successful in a graduate program at a doctoral intensive research university if they so choose.

Industrial Technology – Training and Development Option

This option was discontinued as part of the 2002 accreditation cycle.

- Ms. L.A. successfully completed an M.S. degree and is currently a fulltime Ph.D. student.

Industrial Technology – Manufacturing Option

- Mr. D.L. successfully completed an M.S. degree and is currently working in industry.
- Mr. A.S. successfully completed an M.S. degree and is currently pursuing a career in the military.
- Mr. C.H. current fulltime M.S. student.
- Mr. B.S. current fulltime M.S. student

Industrial Technology – Occupational Safety Option

- Ms. D.H. successfully completed an M.S. degree and is currently working in industry.
- Mr. J.J. successfully completed an M.S. degree and is currently employed and pursuing a Ph.D. on a part-time basis.
- Mr. C.S. successfully completed an M.S. degree and is currently employed fulltime in industry.
- Mr. T.M. successfully completed an M.S. degree and is currently a fulltime Ph.D. student.
- Mr. J.M. current fulltime M.S. student.
- Mr. A.M. currently working in industry and pursuing a M.S. on a part-time basis.

Preparing agricultural systems technology students for graduate programs is not a primary goal of the program. However, success in graduate education can be considered a secondary indicator of the quality and success of the undergraduate agricultural systems technology program. A graduate program for the agricultural systems technology students was not available at Iowa State University until after the department merger in 2004. Since it has become a viable option, 2 agricultural systems technology undergraduates have entered the department’s graduate programs. These students are presented here as evidence that our undergraduate agricultural systems technology students can be successful in a graduate program at a doctoral intensive research university if they so choose.

Agricultural Systems Technology – Agricultural and Biosystems Management Option

- Mr. B.C. Current fulltime M.S. student.
- Mr. J.H. Current fulltime M.S. student.

SECTION 7.17

Student Success in Passing Certification Exams: *If a goal of the program/option is to prepare students to pass certification examinations, then the success of students in passing these examinations shall be tracked and confirmed. Summary data shall be available showing student success in passing certification exams.*

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Currently the goal of the Industrial Technology and Agricultural System Technology programs does not include passing certification examinations; however, the department supports and the faculty encourage students to participate in certification processes. The department has future plans to include the NAIT certification exam as an additional measure of outcomes assessment. In addition, the department has future plans to establish a stronger positive encouragement to students that participate and pass either of the National Association of Industrial Technology or Society of Manufacturing Engineers certification exams. The data for the students that have participated in the certification processes are listed in Table 7.17.1 and 7.17.2.

Table 7.17.1 National Association of Industrial Technology Certification Exam Data for ABE Department

Year	# Students	% Passed	Mean Score	Score St. Dev
2002	4	100	99	2.63
3003	0	-	-	-
2004	0	-	-	-
2005	4	100	90	10.7
2006	0	-	-	-
2007	0	-	-	-

Data is collected from the National Association of Industrial Technology Board of Certification.

Table 7.17.2 Society of Manufacturing Engineers Certification Exam Data for ABE Department

Year	# Students	% Passed	Mean Score	Score St. Dev
2002	0	-	NA*	NA*
3003	0	-	NA*	NA*
2004	0	-	NA*	NA*
2005	0	-	NA*	NA*
2006	0	-	NA*	NA*
2007	11	27	NA*	NA*

* Data from the Society of Manufacturing Engineers was requested but not received.

SECTION 7.18

Advisory Council Approval of Overall Program: *An industrial advisory council shall exist for each program/option and shall have responsibility for general outcome and competency validation and the evaluation of overall program success. Guidelines for the advisory council shall exist that include: (a) criteria for member selection; (b) procedures for selecting members; (c) length of member appointment; (d) council responsibilities; (e) frequency of meetings (at least one per year); and (f) methods of conducting business. Minutes of advisory council meetings shall be made available to the visiting team.*

7.18 Advisory Council Approval of Overall Program: *An industrial advisory council shall exist for each program/option and shall have responsibility for general outcome and competency validation and the evaluation of overall program success. Guidelines for the advisory council shall exist that include: (a) criteria for member selection; (b) procedures for selecting members; (c) length of member appointment; (d) council responsibilities; (e) frequency of meetings (at least one per year); and (f) methods of conducting business. Minutes of advisory council meetings shall be made available to the visiting team.*

The Agricultural and Biosystems Engineering department has an External Advisory Council (EAC) that helps the department. The EAC serves as an external voice for all the degree programs offered by the department. The current EAC has thirteen members active and those members are:

2008 External Advisory Council Members

Buss, Larry
Chief, Hydrologic Engineering Branch
US Army Corps of Engineers

Chhabra, Roshan
General Manager, Engineering Operations
General Electric Company

Frandsen, Matt
Project Manager
Weitz Agricultural

Hamilton, Philip
ACIG Technical Specialist
Rockwell Automation

Hoehn, Klaus
VP Advanced Tech & Engr.
Deere & Company

Igli, Kevin
VP & Chief Environmental Officer
Tyson Foods, Inc.

Leonard, Ronald
Retired
John Deere

Loyd, Bob
Plant Manager
Clipper Turbine Works

Mommsen, Mark
Operations Management Asst.
General Mills

Riediger, Craig
Director in Technology & Solutions
Caterpillar, Inc.

Riskowski, Gary
Professor & Department Head
Texas A&M

Wilcox, Scott R.
Engineering Supervisor
John Deere Harvester

Xie, Liansuo
Manager, Research & Development
Townsend Engineering

Criteria for Member Selection

Membership of the council is expected to be representative of the diverse activities and constituencies of the college. The External Advisory Council is composed of a maximum of 20 members, with at least one half residing within the state of Iowa.

Procedures for Selecting Members

The members are appointed by Department Chair of the Agricultural and Biosystems Engineering Department with advice from current External Advisory Council members and the Agricultural and Biosystems Engineering faculty.

Length of Member Appointment

The term of membership is three years with a maximum of two consecutive terms. Terms are staggered so that five members will be appointed/reappointed each year. Retiring members are eligible for reappointment after a one-year period. The membership year begins at adjournment of the spring meeting of the council and extends to adjournment of the next spring meeting.

Council Responsibilities

The External Advisory Council is a group of industrial, business, legislative, and professional leaders who are interested in the vitality of Agricultural and Biosystems Engineering department at Iowa State University. The council helps ABE to strengthen its learning, research, and outreach programs, improve its facilities, expand its base of support, and serve its alumni. Council members actively participate in the continual assessment of ABE progress and the development of ABE/industry/stakeholder partnerships.

Frequency of Meetings

The council normally meets in the spring and in the fall of each academic year. In addition to the two regular meetings held each year, special meetings of the council and of its committees may be called by the EAC chair.

Methods of Conducting Business

The Agricultural and Biosystems Engineering Department Chair is an ex-officio member of the council. The office of the Agricultural and Biosystems Engineering Department Chair acts as secretariat for the council.

The officers of the council consist of the chair, chair-elect, and past chair; they are elected from the membership of the council. The term of service of the officers is one year June 1-May 31. They are eligible for re-election for one additional term. The officers are chosen without regard for their normal period of service on the council, and their appointment is automatically extended until the end of their tenure in office if their three-year term as member expires during their term of service.

The EAC chair shall preside over meetings of the council and provide guidance in achievement of its goals. The EAC chair-elect shall preside over council meetings in the absence of the EAC chair and has responsibility for coordinating the activities of the ad-hoc committees of the council with the exception of the nominating committee. The EAC past-chair serves as chair of the nominating committee. Members of the nominating committee are appointed annually by the chair of the External Advisory council.

Election of the EAC chair-elect takes place at the spring meeting of the council. A simple majority of votes cast by members present is required for election.

The EAC chair, in collaboration with the Agricultural and Biosystems Engineering Department Chair, sets the dates for meetings of the council. The Office of the Agricultural and Biosystems Engineering Department Chair is responsible for arrangements and, in collaboration with the chair, prepares the agendum for each meeting and mails it to all members of the council at least ten days prior to each meeting. At the end of each meeting, the council makes suggestions for the agendum for the next meeting. The council normally acts as a committee of the whole, but committees may be appointed by the chair to undertake specific assignments.

Revisions to the bylaws can be proposed by any council member and by the ABE Department Chair. Proposed revisions must be distributed in writing to all members of the council at least ten days prior to the meeting where action on the proposals will be taken. A two-thirds majority of all members present is required for approval.

Minutes of EAC

The minutes of the External Advisory Council meeting and the EAC Bylaws are available in Appendix 7.18.

SECTION 7.19

Outcome Measures Used to Improve Program: *Evidence shall be presented showing how outcome measures (Student Satisfaction with Program/Option, Initial Employment of Graduates, Job Advancement of Graduates, Employer Satisfaction with Job Performance, Student Success in Advanced Programs, Student Success in Passing Certification Exams and Advisory Council Approval of Overall Program) have been used to improve the overall program/option.*

7.19 Outcome Measures Used to Improve Program: *Evidence shall be presented showing how outcome measures (Student Satisfaction with Program/Option, Initial Employment of Graduates, Job Advancement of Graduates, Employer Satisfaction with Job Performance, Student Success in Advanced Programs, Student Success in Passing Certification Exams and Advisory Council Approval of Overall Program) have been used to improve the overall program/option.*

Measures Used to Improve Programs

Continuous Curricular Improvement

The Continuous Curricular Improvement process for the Agricultural Systems Technology and Industrial Technology Programs in illustrated in Figure 7.19.1. Key aspects of this process are:

1. In consultation with constituents and our External Advisory Council, the mission, goals and objectives of the program are reviewed (and changed as necessary) every three years. From this process, the desired student learning outcomes are developed, taking into account NAIT accreditation (AST and ITec) and the American Society of Agricultural and Biological Engineers recognition (AST) criteria.
2. Each course in the curriculum is examined to determine which of the outcomes it addresses. The curriculum as a whole is examined to ensure adequate coverage of the outcomes. Should there be gaps in coverage, the curriculum is re-examined to determine if different courses are needed, or if courses within the department need to be changed or added to ensure all the outcomes are adequately addressed.
3. We determine from the outcomes-competency matrix which competencies are addressed in each of the courses taught in our department. We thus know which competencies should be focused on in each course. Faculty members designate key assignments in each course that students can use to demonstrate these competencies in their portfolios.
4. The primary evidence of students achieving the outcomes (or in our case, achieving the competencies) is direct evidence of performance: student portfolios, workplace evaluations of students on internships, the results of certification exams, employer evaluation of graduates two years post graduation, graded homework, and student performance in their capstone experience (TSM 415 and 416). Indirect measures (e.g., senior exit surveys, student evaluation of instruction, post graduate surveys, program reviews, advisor evaluations and placement statistics) are reviewed as background information but are not the basis of judgment for the attainment of outcomes. We do not use course grades as an assessment measure because they are not objective measures of student performance relative to individual outcomes.
5. The direct and indirect measures are reviewed annually by the Technology Curriculum Committee to identify strengths and weaknesses of the program, and in consultation with the ABE External Advisory Council, makes recommendations for change. The faculty as a whole (e.g., curriculum changes) or individual faculty (specific courses) implements the recommendations.

We are just now implementing this Continuous Curricular Improvement process for the Agricultural Systems Technology and Industrial Technology programs. We are confident that this process will be successful because of our successful experiences using it in the Agricultural Engineering program. But because we are now just implementing this process, we do not yet have a significant amount of data from which to inform improvements to the programs.

Changes Made to the Program

Competency assessment data that we have collected so far (see section 7.11) has confirmed our observation and student self-assessment that Innovation, Communication and Customer Focus are among the students' lowest ranked competencies.

We have already taken steps to improve the Innovation and Customer Focus competencies:

1. We have created the required sophomore seminar course TSM 201 (Internship and Entrepreneurship). In this course are explicit learning experiences related to Innovation and Customer Focus.
2. TSM 444 (Facility Planning, a required course for the ITec manufacturing option) has shifted to a more entrepreneurial approach. Like the sophomore seminar, this course explicitly covers Innovation and Customer Focus.
3. We have begun discussing with faculty the need to include more open-ended problem solving in all our courses. Problems with no single correct solution encourage innovation.
4. Addressing the Communication competency means to us a more purposeful integration of communication experiences into our own courses. Taking additional or different communication-related courses will not be effective. Students must find meaning within their own future profession. We have taken these initial steps to improve the Communication competency:
5. Through our learning community, we will be linking TSM 210 (Fundamentals of Technology, required by all options), TSM 201 and English 250 (Written, Oral, Visual and Electronic Composition) in the spring of 2009. In these courses, students will share some common assignments focusing on communication skills.
6. We have begun discussing developing common rubrics to evaluate the Communication component of assignments, papers and presentations in all TSM courses. Consistent expectations and evaluation across the curricula will promote demonstration of the Key Actions associated with the Communication competency.

We look forward to the analysis of future assessment data that will guide further improvements to the AST and ITec programs.

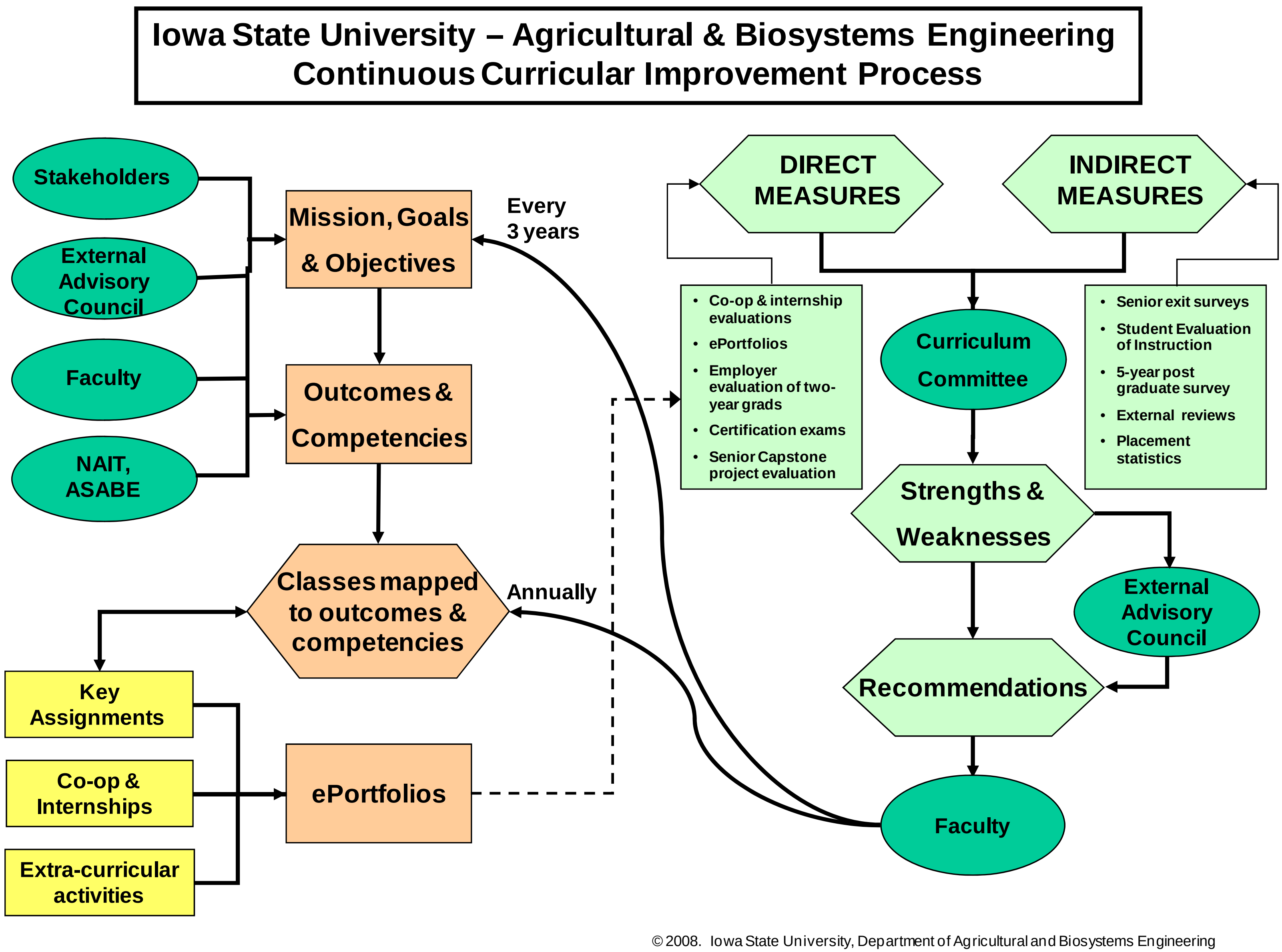

Figure 7.19.1. The ABE Continuous Curricular Improvement Process