ENGINEERING EDUCATION AND THE CONTINUOUS IMPROVEMENT PROCESS

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Abstract.

This paper discusses a business perspective of engineering education which is being applied at the Mechanical Engineering Department at Alabama A&M University to facilitate continuous improvement of the curriculum. This perspective has been developed to better position the program in the context of the Accreditation Board for Engineering and Technology (ABET) criteria 2000, which emphasizes an outcome-based philosophy. This paper examines the development, implementation and results of the use of assessment tools in seeking continuous program improvement in Mechanical Engineering at Alabama A&M University.

Under the new ABET criteria 2000, engineering educators are being challenged to, not only, revise the content, depth and perspective of the engineering curriculum, but also to adjust, and adapt or re-invent traditional approaches to teaching and student progress' assessment. Some educators ask: "why change traditional and proven methods". To simply respond that engineering education faces a "new paradigm", or that there are new accreditation rules, is insufficient.

In order to discuss the continuous improvement challenge it is advantageous to change "hats" and consider ourselves as non-academicians whose business is part of, and directly influenced by a global economy. In the context of a global economy we find ourselves as consumers or/and suppliers of products or/and services, and as such we will, most likely, seek competitive products at competitive cost.

Through a product/service perspective, we will find that engineering education is a knowledge-base activity that defies consistent product definition. We find that it is highly customer interactive, contains an abundance of intangible events and is geared to provide a unique educational experience, which borders into individualized instruction. As a consequence of this new perspective, we find that educators must negotiate/determine how to better meet the needs of each student and provide to them the necessary preparation to compete effectively for professional careers in engineering.

To define new set-points in this determination, educators must find ways to continuously assess their success in meeting the needs of students to achieve their educational objectives. This is where assessment tools can be of utility. This paper examines a variety of assessment tools that have been developed/adapted and implemented by the chairperson and faculty of the department of Mechanical Engineering at AAMU to improve the program.

The ME department assessment tools were designed to provide data for feedback, regarding program objectives, teaching practices, curriculum content emphasis, and student development of professional competencies

In this paper, the authors advance the view that the continuous improvement process applied to educational programs serves to build and maintain a competitive engineering program. To effectively implement this process however, a buy-in consensus by faculty and students and the program's other constituencies is required.

BACKGROUND

Alabama A&M University (AAMU) is a land-grant, historically black university. It is located in the northeast outreach of Huntsville, Alabama, an important world center of expertise for advanced missile, space transportation and electronic research and development. Among the leading industry and government agencies located in this area are the NASA Marshall Space Flight Center, the Army Aviation and Missile Command Center (AMCOM), Redstone Arsenal and Testing Center, The Boeing Company, Northrop Grumman, Lockheed Martin Aerospace, Thiokol and many others associated with high-tech. endeavors. These industries and government agencies require large numbers of highly trained engineers in all disciplines. The Mechanical Engineering program at AAMU provides specialization in the areas of manufacturing and propulsion systems.
The interaction between the aforementioned organizations and academia is today leaning towards research contracts that have designated outcomes in terms of deliverables. Technical monitors and faculty members work closely to benchmark progress towards set goals. Time management, resource allocation, budgeting and timely evaluations of unanticipated problems, are processes that researchers must manage effectively in order to sustain a lasting interaction with industry and government agencies that, in turn, can enhance the engineering education process.

ENGINEERING EDUCATION AND THE CONTINUOUS IMPROVEMENT PROCESS

ABET criteria 2000, emphasizes an outcome-based system approach to engineering education. Under the new criteria 2000, engineering educators are being challenged to, not only, revise the content, depth and perspective of the engineering curriculum, but also to adjust, and adapt or re-invent traditional approaches to teaching and student progress' assessment to match published programs' educational objectives and educational outcomes. This situation is related to the notion of accountability for the whole program and, in essence, it is not a big stretch to acknowledge that instructors and lecturers should be held responsible for delivering the instructional material described in course syllabi. However, a typical response to change is to question why change is necessary. Many colleagues/educators ask: why change traditional and proven methods. To simply respond that engineering education faces a "new paradigm", or that there are new accreditation rules, is insufficient. But even elaborating a credible argument for change, the traditional academician will further note that this situation adds additional stress in the program by requiring that new material be incorporated into the coursework i.e. ethics, environmental issues, contemporary issues, economics and others. The traditional approach of adding another "patch" or another course in the program is no longer sustainable. This is why a different (systems) approach is necessary. Another sector of academia on the other hand are more familiar with the business perspective, while conducting contractual research, the statements of work detail the degree of accountability required to satisfy the contract in terms of deliverables.

In any event, achieving change in educational practices is not an insurmountable task as long as there is an identifiable purpose, a clear product definition and a structure to follow. And this is where a few difficulties arise. With a product/service perspective we find that engineering education is a knowledge-based activity that defies standard product definition. Indeed, we find that engineering education is highly customer interactive, contains an abundance of intangible events and aspire to provide students with a unique and rewarding experience. Under this light, it may be mistakenly concluded that business practices have no place in engineering education. However a deeper examination does reveal that a business perspective can contribute in finding ways to improve engineering education.

In the context of a global economy, as consumers or/and suppliers of products or/and services, we feel not only assertive but also smart while seeking competitive products at competitive cost. Industry will strive to provide competitive products by reducing total cost, reduced time to market, increased quality and enhancing customer support services among other initiatives. Extrapolating this concept into the educational endeavor, wouldn't it be great to have students to master or achieve the goals for courses in half of the time instructors regularly spend. Would industry welcome universities' efforts if they were to deliver qualified engineers in three years instead of five years? Will parents and scholarship sponsors welcome paying tuition cost just for three years instead of doing it for five years? Of course! . However the scenario depicted is easily stated but far removed from the present reality.

Yet, from the business perspective some universities are already offering programs of study via the internet to students who need and appreciate the convenience of access, and self-paced instruction without incurring in cost associated with moving closer to the university campus or without having to leave their present jobs. The virtual university is a technological reality that is gaining an important part of the available student population, i.e. part of the educational market share. To "stay in business," universities must take advantage of innovative approaches to recruiting and retaining what we all consider a valuable commodity, i.e. high quality students. One of the better ways to accomplishing this is to develop a high quality program and continuously improve it through the use of a well thought process. This paper describes the process initiated in Mechanical Engineering at AAMU in Huntsville Al.

THE CONTINUOUS IMPROVEMENT PROCESS

Continuous improvement is an inherently engineering process. As engineers seek to improve, optimize, implement and re-engineer processes to keep products competitive, they just exercise the process they were educated to perform. A first fundamental step in the continuous improvement process is to make an objective determination of the product/service performance base-line, i.e. to benchmark the product relative to the competition's products. The next step is to determine where the product needs to be to stay competitive. The gap between the two (where it is and where it needs to be) is defined as the technological gap. Bridging the gap may represent the difference between staying profitable or dropping out of the business. University engineering programs too are expected to be profitable by attracting highly qualified students and graduating successful and productive engineers. Non-profitable engineering programs may be considered to be phased out in times where budget cuts are unavoidable or when accountability via program output, (graduates per year) is below established guidelines. The issue then resolves itself into the establishing a continuous improvement process to insure that the engineering program remains profitable in the previous context and developing a system of metrics to measure the success of the program.

ASSESSMENT INITIATIVE

The Mechanical Engineering Program at Alabama A&M University is implementing a set of assessment tools which have been developed/adapted and tested to provide input regarding the educational process to improve the program. The tools satisfy a twofold purpose: providing metrics to measure students progress towards achieving program educational objectives and helping faculty to focus on areas in the program which need improvement.

The assessment tools were designed to provide data to serve as feedback information, regarding program objectives, teaching practices, curriculum content emphasis, and student development of professional competencies. A subset of these tools is listed in the appendix section as well as some of the results of their use.

Pertaining to the ABET 2K criteria it becomes of outmost importance to show how results of the assessments provide elements for the faculty to adjust/change or if necessary delete elements of the educational common practice. It is quite important to validate the results of the assessment before any significant modification is made to the prevailing educational objectives and outcomes. Once it has been agreed that adjustments/changes to the curriculum content are needed, a corresponding must be done in the assessment tools. The results of the assessment should clearly show advantages to the teaching practice and produce enhancements to student progress regarding achieving their educational objectives and educational outcomes.

ASSESSMENT TOOLS

The set of tools used in this evaluation consist of questionnaires given to students so that they evaluate outcome results on several categories. The assessment tool (AT) was given an identification number to facilitate departmental coding. Description of the code and goals of the survey are listed below. Examples of some of them are shown in the appendix section as well as a summary table of a review of the AT’s. The numbering of the tools is somewhat arbitrary to avoid implying a level or priority.

1) AT6 Program Objectives Student Survey . Designed to evaluate the student’s awareness of the Educational objectives and Educational outcomes that the ME program has defined as its Program Objectives.
2) AT1 Student Observation Form. Designed to make instructors aware of the ways to improve their teaching methodology.
3) AT 3. Course Content Interest Survey. Designed to make instructor aware of student's suggestions to spend more or less time on course topics.

4) AT 2. To make students aware of the student's view of how the class helps in building professional competencies
5) AT8. To provide input to the ME program on the relevance of the curricula in assisting graduating engineers to obtain employment in the field.
6) AT7. Provides input to students on their communication skills and serves to document educational outcomes.

The authors are aware of the preliminary nature of the assessment tools and the results derived from them. Since the evaluation of these tools is still in progress, this paper will not discuss everyone in great detail. Since the focus of this paper is to address a process of continuous improvement, the discussion of some of the results obtained are a sample of the metrics that a tool should provide for decision making.

RESULTS

As discussed above, the presentation of results and the analysis of the data is shown here as an example for developing metrics and establishing benchmarks than a final conclusion of both the effectiveness of the assessment tools or the discussion of the tabulated data.

Through survey tools like AT1, students provide an opinion on instructor's teaching techniques/style. The information becomes a starting point for instructors to review his/her teaching practice. This form is designed to provides instructors with some guidelines on how to improve their lecture/laboratory presentation. AT1 is shown in the appendix section. A chart follows the survey form. And it shows the results for one of the faculty members of the department. The faculty member analyses his/her data and share the results with the department chairperson. Through the review process, recommendations are given to improve the delivery methods. The faculty member can compare the information obtained each semester to determine if the changes have produce improvement in the teaching technique.

Assessment tool AT3 consist of a questionnaire given to students regarding course resource allocation. Students provide input to the instructor about their interest to have more or less time spent in the course topics. This provides information to the lecturer/instructor to ways to try to make more effective use of time on particular subjects that may be more difficult to students to master. Example of AT3 is also shown in the appendix, followed by a chart for a particular course in the ME curriculum.

The Program Objectives Student Survey (AT8) evaluates student awareness of the program objectives. During the period of assessment, the following objectives were publicized:

Mechanical Engineering Program Objectives 1998-2000

[PO1]. To provide students with a solid preparation in Mechanical Engineering to pursue professional carriers in this field and develop professional skills for lifelong learning;

[PO2]. To provide a strong, fundamental education in areas of Mechanical Engineering such as thermal and mechanical sciences and system design;

[PO3]. To provide laboratory experiences to develop students' skills in design of experiments, laboratory safety, data acquisition, instrumentation, and laboratory report writing;

[PO4]. To develop computer competency and an intelligent use of computers as tools for developing solutions to engineering problems;

[PO5]. To provide flexibility through the offering of technical electives so that students may acquire additional competence in current and emerging technologies that will allow them to pursue their individual carrier objectives, while being prepared to participate and contribute to the technology-driven global economy.

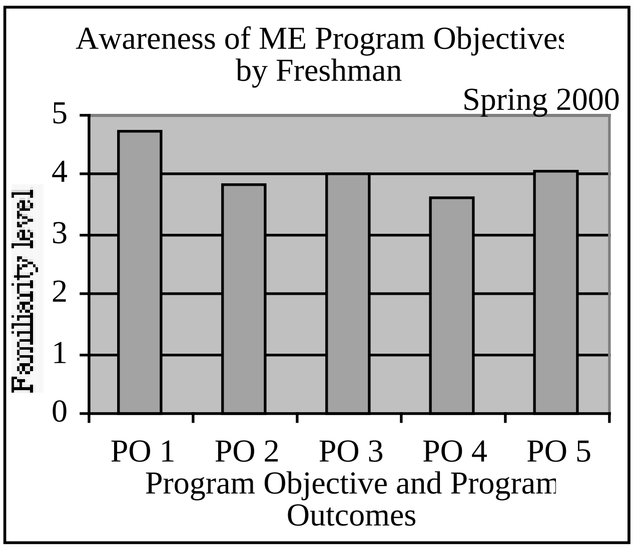

Figure 1. Awareness of objectives - Freshman

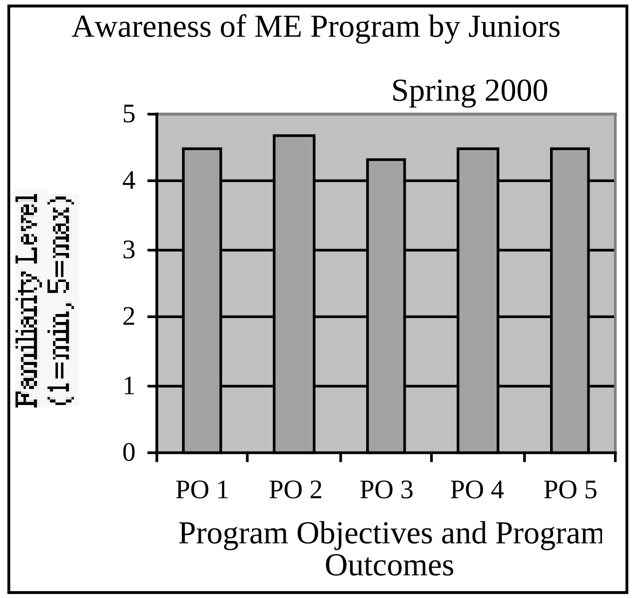

Figure 2. Awareness of objectives -Juniors

The results indicate that the awareness level of the five program objectives varies between freshman and seniors from moderate levels of awareness to full awareness by the time students are seniors in the program. The review indicates that the department is doing a good job in communicating to students the program objectives.

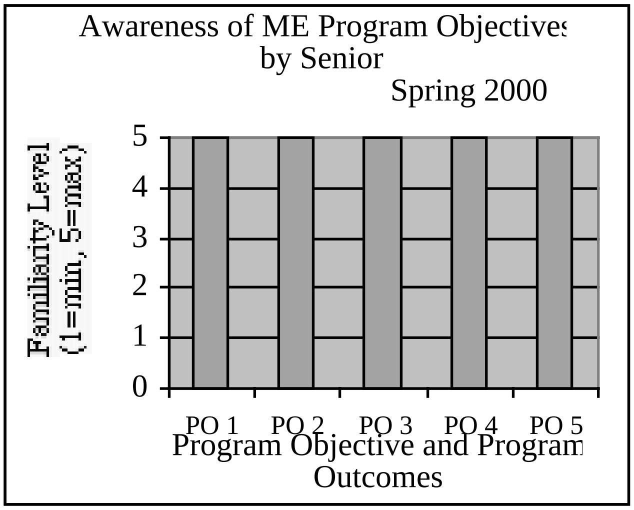

Figure 3. Awareness of objectives - seniors

The results obtained through the assessment tools need to be evaluated in terms of its objectivity and potential bias. To this effect there are sets of well defined parameters within statistical analysis that can render an opinion on the level of confidence associated with the data obtained. These parameters are related to sample size and control groups. (i.e. placebo group vs. modified practice group).

The intent of this paper is not to discuss the statistical methods associated with sampling techniques but to discuss the need of a process to continuously improve the engineering educational practice.

CONCLUSIONS

Assessment tools were designed to provide data to serve as feedback information, regarding program objectives, teaching practices, syllabi content emphasis, and student development of professional competencies to implement a continuous improvement process in the Mechanical Engineering Program at AAMU. A number of voluntary actions have taken place by faculty members that address the information gathered throughout the set of AT's. However the faculty is cognizant that in order to achieve high statistical levels of confidence in the data obtained, it is necessary to have a sample pool larger than what it is available at this time. Therefore the information obtained is view with interest and also with caution to avoid misjudging of the data obtained.

The evaluation tools have been used for two years previous to the writing of this paper. The information gathered was instrumental in providing documentation to the ABET accrediting team during their visit the following year. Results of the evaluations has been discussed with both, faculty and the departmental industrial advisory board. Both faculty members and the department advisory board have expressed interest and enthusiasm to continue the assessment process and each group has made recommendations to improve the assessment tools. A review of the tools has been initiated as part of the continuous improvement process. The results of the suggested modifications will be discussed in a future paper.

The authors advance the view that the continuous improvement process applied to educational programs serves to build and maintain a competitive engineering program. Without the availability of a "proven recipe" it makes it more pressing to refine processes leading to the continuous improvement of the engineering educational practice.

Bibliography/References:

1. Taxonomy of Educational Objectives, Bloom et al.,Handbook 1. Cognitive domain, New York; David McKay Company, 1956.
2. Manufacturing Education Plan: Phase I Report. "Industry Identifies Competency Gaps Among Newly Hired Engineering graduates. Published by the Society of Manufacturing engineers and the SME Education Foundation
3. Integrating the Product Realization Process (PRP) into the Undergraduate Curriculum . The American Society of Mechanical Engineers, December 1995.
4. Curriculum Integrated Product and Process Development - Patrick F. Cunniff, David C. Holloway, James W. Dally, Peter A. Minderman, Jr. , Jane f. Fines and Thomas M. Regan. A. James Clark School of Engineering, University of Maryland, college Park, MD 20742-3011.
5. BCAG Summer intern Training Program – Selected Airplane Design Exercises – The Boeing Company.
6. Basic Tools for Problem Solving and Design Teams - The Boeing Company.
7. Questions of Integrity – The Boeing Ethics Challenge – Edited by Nancy McCready Higgins, Director of Ethics and Business Conduct, The Boeing Company.

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Appendix A. ME Department – AT1 – STUDENT OBSERVATION FORM*

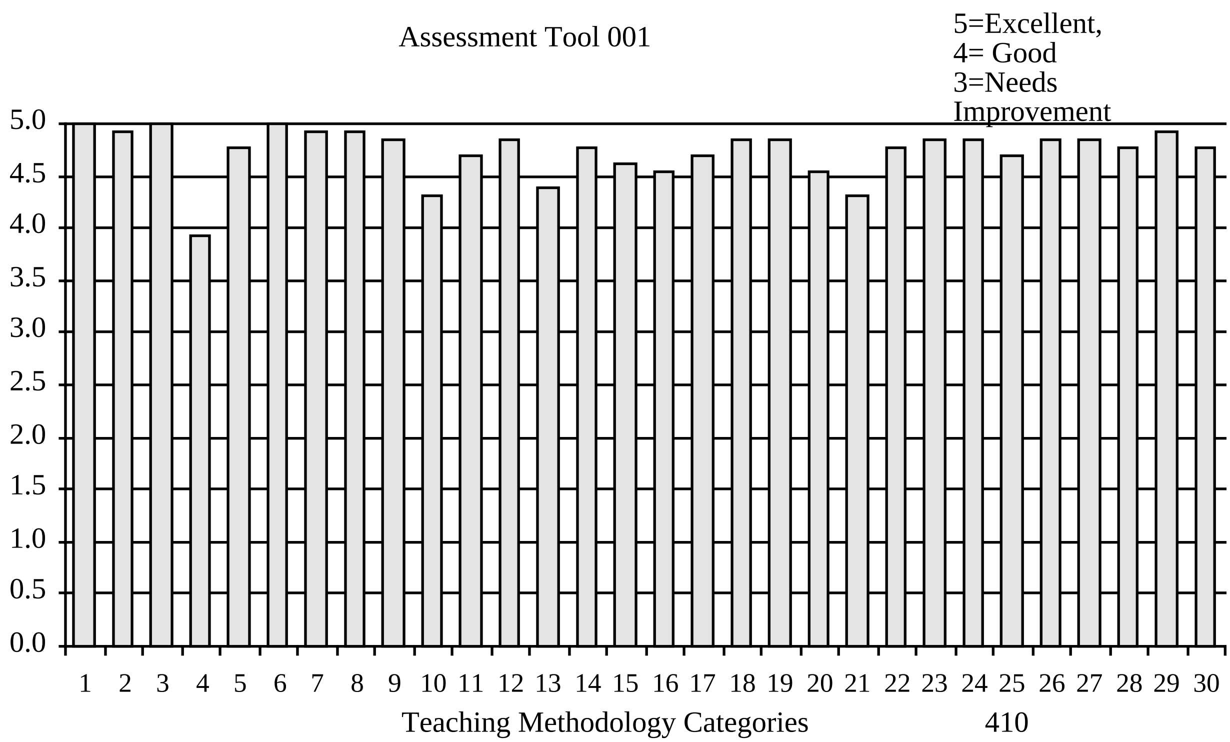
Instructor's Name ____________________ **Course** _________ **Sec.:** _____ **Date** _______

Directions: Rate the observed teaching methodology using the following scale:

A - Excellent B - Good C - Needs Improvement D - Not Applicable

Q. 1	Instructor's voice can be heard every where in the classroom	A	B	C	D
Q. 2	Instructor's vocal patterns are varied and dynamic	A	B	C	D
Q. 3	Instructor makes eye contact with students	A	B	C	D
Q. 4	Instructor does not talk beyond student comprehension	A	B	C	D
Q. 5	Instructor gestures to emphasize and clarify ideas	A	B	C	D
Q. 6	Instructor promotes an atmosphere of understanding and respect	A	B	C	D
Q. 7	Instructor encourages students to answer each other's questions	A	B	C	D
Q. 8	Instructor probes for correct responses rather than answering his/her own questions.	A	B	C	D
Q. 9	Instructor allows 5 second wait time for a student to answer before restating the question or asking another student.	A	B	C	D
Q. 10	Instructor ask students to justify and explain thoughts. A	B	C	D	
Q. 11	Instructor provides guidance and feedback to all students	A	B	C	D
Q. 12	Instructor do not praise students in a mechanical way	A	B	C	D
Q. 13	Instructor presents information inferring a general conclusion from particular results.	A	B	C	D
Q 14	Instructor presents information deriving a conclusion from reasoned analysis.	A	B	C	D
Q. 15	Instructor structures and organize course contents in such a way that allows progressive learning.	A	B	C	D
Q. 16	Instructor presents information using a variety of visual media : chalkboard, maps, pictures, charts, gestures, mime.	A	B	C	D
Q. 17	Instructor gives a variety of explanations, models or descriptions	A	B	C	D
Q. 18	Instructor gives examples of various degrees of complexity.	A	B	C	D
Q. 19	Instructor regularly structures opportunities for students to work in pairs or groups as well as independently.	A	B	C	D
Q. 20	Instructor builds in opportunities for students to be evaluated using varied modes rather than only one: i.e. independent projects, small group activities, written reports, objective test.	A	B	C	D
Q. 21	Instructor finishes the class session with some form of review of the material presented that day.	A	B	C	D
Q. 22	Instructor begins the class session with some form of review of the material presented the previous session.	A	B	C	D
Q. 23	Instructor engages students in active learning and direct experience when possible.	A	B	C	D
Q. 24	Instructor does not make students feel potentially threatened by asking too many questions.	A	B	C	D
Q. 25	Instructor makes regular comprehension checks in the form of specific questions (versus "Is that clear").	A	B	C	D
Q. 26	Instructor is egalitarian in questioning and attempts to call as many students as possible.	A	B	C	D
Q. 27	Instructor relates his subject matter to other subjects in the curriculum.	A	B	C	D
Q. 28	Instructor relates the subject matter to practical applications.	A	B	C	D
Q. 29	Instructor makes himself/herself available for consultations outside the classroom.	A	B	C	D
Q. 30	Instructor selection of supporting lecture material assist the student' self-learning experience. (i.e. Text, hand-outs, news releases, notes, tapes, movies, other references)......	A	B	C	D

Adapted from Kate Kinsella's work on cognitive development and learning styles by Dr. Ruben Rojas-Oviedo.



A = 5 = Excellent B = 4 = Good C = 3 = Needs Improvement D = 2 = Not Applicable

Figure 4. Tabular data of Survey AT1.

Appendix B. Mechanical Engineering Department Course Assessment Form # 002 Fall 2000

Class:_____ Semester: _______ Year:_____

Referring to the list below: Please qualify by selecting numbers 5 to 1 in terms of class content/ project relevance in assisting you to develop such competencies. (5-Highly relevant to 1-Not applicable)

	Competencies	5	4	3	2	1
1	Teams/Teamwork					
2	Communication					
3	Design for Manufacture					
4	CAD Systems					
5	Professional Ethics					
6	Creative Thinking					
7	Design for Performance					
8	Design for Reliability					
9	Design for Safety					
10	Concurrent Engineering					
11	Sketching/Drawing					
12	Design for Cost					
13	Application of Statistics					
14	Reliability					
15	Geometric Tolerancing					
16	Value Engineering					
17	Design Reviews					
18	Manufacturing Processes					
19	Systems Perspective					
20	Design for Assembly					
21	Design of Experiments					
22	Project Management Tools					
23	Design for Environment					
24	Solid Modeling/Rapid Prototyping Systems					
25	Design for Ergonomics (Human Factors)					
26	Finite Element Analysis					
27	Physical Testing					
28	Total Quality Management					
29	Design for Service/Repair					
30	Product Testing					
31	Process Improvement Tools					
32	Tools for "Customer Centered" Design					
33	Information Processing					
34	Leadership					
35	Statistical Process Control					
36	Test Equipment					
37	Industrial Design					
38	Design for Commonality-Platform					
39	Computer Integrated Manufacturing					
40	Design Standards (e.g. UL, ASME)					
41	Mechatronics (Mechanisms and Controls)					
42	Testing Standards (e.g. ASTM)					
43	Electro-mechanical Packaging					
44	Conflict Management					
45	Robotics and Automated Assembly					
46	Design for Dis-assembly					
47	Knowledge of the Product Realization Process					
48	Process Standards (e.g. ISO 9000)					
49	Competitive Analysis					
50	Project Risk Analysis					
51	Budgeting					
52	Manufacturing Floor/Workcell Layout					
53	Bench Marking					
54	Corporate Vision and Product Fit					
55	Materials Planning-- Inventory					
56	Business Functions/(Mkt'g, Legal, etc.)					

Appendix C.

Mechanical Engineering Department Assessment Tool # 3

ME 101 SURVEY

Dear Mechanical Engineering Student; This form list topics covered in the ME101 class. Please write down a (+) or a (-) at the right hand side of the topic to indicate if you prefer that more or less time be spent in the topic at hand.

1. Intro to ME Eng. Profile
2. Prelm. Desgn.Pre-Prof Plan SEARK
3. Tools for Problem Solving teamwork
4. Intro. To Prod. Realization Process
5. Project Definition Glider Project.
6. Paths to success undstdg the process
7. Business persp. Vision of big picture
8. Basics of Glider design
9. Weight Analysis mrkt analys for materials.
10. Materials & Materials selection examp.
11. Learning styles team effects
12. Market outlook and research
13. Bernoulli's Equation wind tunnel
14. Calculation of lift and drag
15. Eval. Alternative materials & products
16. Teamwork practices planning
17. Time line practice resource/task schd.
18. Conflict resolution/Prof. Ethics
19. Production techniques
20. Manuf. Testing & product evaluation
21. Final technical report hints

Appendix D. Relative interest levels ME 101

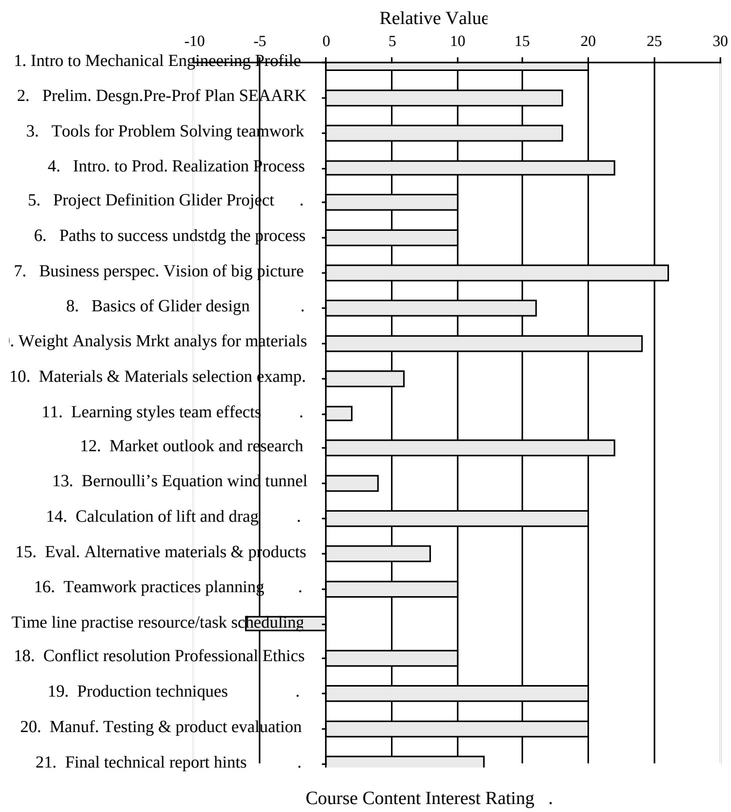


Figure 5. Tabular data of Survey AT3 Course Content Interest Survey

Mechanical Engineering Department
School of Engineering and Technology
Alabama A&M University

Exit Survey Form.

Dear Mechanical Engineering Alumni.

We appreciate your participation in the ME Dept. Exit Survey. Your input is an important element that will be discussed and kept confidential. The material provided will be used for program curricula evaluation. Please help us to update our data base by providing the information indicated below. Thanks for your time and if you have any questions please call us at (256) 851-5890.

Name		**Graduation Date:**	
Present Employer			
Company Address(City/State/Zip Code/Country)			
Home Permanent Address			
City	State	Zip Code	Country
Present Position			No. of Engineers at Place of work:
Work Telephone		Home Telephone	
Work Fax		E-mail Address	

The mechanical engineering basic curricula course listing is shown below. Please qualify by selecting a number from 4 to 1 in terms of relevance in assisting you in obtaining professional employment as mechanical engineer. (4 highly relevant to 1 not applicable)

Year; Semester	Course	Level of relevance 4	3	2	1
Freshman					
1st. Semester	ORI 101 Survival Skills (1)				
	ENG101 Communication Skills I (3)				
	MTH 125 Calculus I (4)				
	CHE 101/101L Gen Chemistry I (4)				
	FAS/HED/NHM 101/103 Health S. (2)				
	ENG 101 Eng. Drawing & Graph (3)				
2nd Semester	ENG 102 Communication Skills II (3)				
	MTH126 Calculus II (4)				
	PHY 105 Physics I (4)				
	EGC 104 Computer Programming (3)				
	ME 101/101L Intro to Mech Eng. (2)				
Sophomore					
1st Semester	MTH 227 Calculus III (4)				
	PHY 106 Physics II (4)				
	HIS 101 Wold History I (3)				
	ME 205 Statics (3)				
	EE 201 Linear Circuits A. I (3)				
	EE 201 Linear Circuits A. Lab I (1)				

Basic Level continues

Year; Semester	Course	Level of relevance 4	3	2	1
2nd Semester	MTH 238 Differential Equations (3)				
	HIS 102 World History II (3)				
	Social Science Elec (3)				
	ME 210 Materials Science (3)				
	ME 206 Dynamics (3)				
Junior yr.					
1st Semester	ECO 200 Basic Economics (3)				
	ME 231 Strength of Materials (3)				
	ME 310 Thermodynamics (3)				
	ME 320 Kinematics/Dyncs of M. (3)				
	ME 360 Fluid Mechanics (3)				
	ME 360L Fluid Mechanics Lab (1)				
2nd Semester	EE 203 Analog Circ. Des/Anal. (3)				
	EE 203 Analog Circ. Des/An. L. (1)				
	ME 300 Math Methods in ME (3)				
	ME 301 Ana & Instrmnt of P.Sys (2)				
	ME 301L Ana&Instrmnt of P.Sys L.(1)				
	ME 312 Heat & Mass Transfer (3)				
	ME 312 Heat & Mass Transfer Lab (1)				
Junior yr.					
2nd Semester	ME 370 Concurrent Engineering (3)				
Senior yr.					
1st Semester	ENG 203 Humanities I (3)				
	ME 432 Desgn for Manuf & Reliab (3)				
	ME 432L Desgn for Man & Rel Lab (1)				
	ME 451 Auto Control Sys (2)				
	ME 451L Auto Control Sys (1)				
	ME 470 Mech Engineering Dsgn P. (2)				
	ME 481 Qual. Reliability Assurance (3)				
2nd Semester	Art/Music Elective. (3)				
	ME 470A Mech Eng. Design Proj (3)				
	ME 472 Econ. Eval of Desgn Proj (3)				
	ME 482 Oper. Planng & Scheduling (3)				
	ENG 204 Humanities II (3)				

Dear Mechanical Engineering Alumni.

We have a few additional questions where your assessment is important. Please qualify with the appropriate response. (5 High-1 Low)

Question	5	4	3	2	1
1. Do you feel that the program has provided you with the skills to advance professionally and continue to learn? ………………					
2. Do you agree that the program has provided you with the skills for solving engineering problems………………………………………………………					
3. Would you recommend the program to high school age students? ………					
4. Would you hire engineers from AAMU ………………………………………					
5. Do you consider the ME faculty a resource for technical advice…… ……					
6. Do you visit the ME Dept. Web page at www.aamu.edu ……………………					
7. Are you receiving the ME newsletter ………………………………………					

Finally, we will appreciate if you share with us your ethnic background and gender.

Male _______ Female_______ Ethnicity.___________

Mechanical Engineering Department AAMU

Summary of Assessment Tools

Last revision: 10/12/ 2000.

Name and Population	Code	Objective/s	Results	Action Items	Periodicity	Keep/Modify
"Program Objectives Student Survey" Pop: ME students	AT6	To evaluate the awareness by the student of the Educational objectives and Educational outcomes that the ME program has defined as its Program Objectives.	Data shows averaged awareness levels at: 81% Freshman, 90% for Juniors 100% for Seniors	1. Improve dissemination of Program Objectives for Freshman	Every Year Either Spring or Fall.	Keep
"Student Observation Form" Pop: ME students	AT1	To make instructors aware of the ways to improve their teaching methodology.	Instructors review the survey and take steps to improve their teaching styles	1. Continue to utilize the survey in every class.	Should be given before MidTerm.	Keep
"Course Contents Assessment" Pop: ME students	AT3	To make instructor aware of student's suggestions to spend more or less time on course topics.	Instructors analyze the data to seek better utilization of time and course organization.	1. Continue to utilize the survey in every class.	Should be given before Finals.	Keep
"Course contribution to Professional Competencies ASME" Pop: ME Students	AT2	To make students aware of the student's view of how the class helps in building professional competencies	Analysis of the data has not been done because, after a long review by the ME IGAB it is the consensus that students may not be the best population for this survey.	1. Reduce # of competencies listed and seek a better population to survey. ME faculty is a possibility.	It can be given once a year	Modify before next application
"Exit Survey Form" Pop: ME Graduates with one year work experience.	AT8	To provide input to the ME program on the relevance of the curricula in assisting graduating engineers to obtain employment in the field.	Data is limited to two surveys. However it is the consensus that the capstone design class is highly relevant.	1. Add a column to survey to assess preparedness plus relevance	It should be part of the longitudinal tracking of ME alumni	Modify before next application.
"Project oral presentation Pop: ME students (freshman to seniors)	AT7	Provides input to students on their communication skills and serves to document educational outcomes.	Data shows students make progress through courses to reach program objectives	1. Utilize the survey in every class.	Given in each class as often as appropriate.	Keep