

## INTERDISCIPLINARY ENGINEERING CAPSTONE PROGRAM

### Team Outcomes:

- \* identify/clarify personal roles in capstone program over next 3-5 yrs
- \* produce a capstone program assessment report for 04-05
- \* design a capstone program assessment exercise involving stakeholders at the end of the current academic year

### Step 1 – Essence (who + what + how)

⇒ distinguish from peer programs

Capstone design is a collaborative community of undergraduates, graduates, faculty, technical advisors, and clients that grow professional engineering skills by using processes to design, build, test, and showcase a product at the UI Design Expo.

### Step 2 – Stakeholders

Undergraduate students	– learn knowledge and skills needed in the workplace; increase employability
Graduate students-	learning how to mentor; advancing technical and management skills; getting paid
Course Instructors	facilitate professional growth of the students, stay current with industrial practices and technology, collaborating with peers in teaching a comprehensive course; acquiring state-of-the-art design tools
Other Instructors	want to see students applying engineering principles in design; recruit graduate students; add value to program; responsible use of resources; ABET compliance; generate excitement about engineering program
Technical Advisors	recruit graduate students; advance an agenda/project; constrained involved
Clients	bandwidth for a back-burner project; high return on investment; visibility among senior class for recruitment; novel approaches to old problems; contribute to professional growth of students and faculty; stay involved with UI

College Administrators ABET compliance; add value to college; promote industry contacts; recruiting students; build infrastructure for research opportunities; entrepreneurship; inter-disciplinary interaction

Development Office Showcase for potential donors; pool of students and faculty for courting donors; material for marketing collateral;

Advisory Boards preparation of entry-level students; dialoguing with students; provide guidance for program development; stay involved with UI; networking with project sponsors

### Step 3 – Scope

WHAT IT IS	WHAT IT ISN'T
Teaching people how to produce return on investment	Profit center for university
Open-ended design experience	Scripted design problem with known solutions
Set of value-added processes	Totally unstructured experience
Community of facilitators	Single instructor
Failure is allowed	Risk-free environment
Mentored	Directed
Project centered learning	Fixed curriculum

Design-build-test	Design
New product, system, or method	Research project
Awaited, exciting experience	Means for fulfilling a requirement
Vested sponsor	Pro Bono

Step 4

	Current Goals	Future Goals
Continuous Improvement Of the Program	Effectiveness and efficiency <ul style="list-style-type: none"> <li>• website</li> <li>• notebooks</li> <li>• cost model</li> <li>• infrastructure investment (HW and SW)</li> </ul> Venue for ABET data collection	Improve value of client relationship  Annual assessment report  Identify, clarify and actualize program roles

Professional Growth	Prepare students for professional practice <ul style="list-style-type: none"> <li>• Ethics</li> <li>• Teamwork</li> <li>• Communication</li> <li>• Lifelong learning</li> </ul>	Further our knowledge base
Engineering Experience	Provide a practical engineering experience <ul style="list-style-type: none"> <li>• DBT</li> <li>• Customer needs</li> <li>• Real world constraints</li> <li>• State-of-the-art tools</li> </ul>	Research Piece
Develop and Expand Community	COE community <ul style="list-style-type: none"> <li>• Interdisciplinary course offering</li> <li>• Graduate student mentors</li> <li>• Technical advisors</li> <li>• Clients</li> </ul>	Diversity beyond COE <ul style="list-style-type: none"> <li>• Entrepreneurial</li> <li>• business</li> <li>• Presentation skills</li> <li>• Graphic design</li> </ul> Identify, clarify, and actualize

	<ul style="list-style-type: none"> <li>• Instructors</li> <li>• Extended community (papers)</li> </ul>	<p>program roles</p> <p>Impact curriculum</p> <ul style="list-style-type: none"> <li>• Prereqs courses</li> <li>•</li> </ul>
Product Marketing	<p>Showcase student abilities and team skills</p> <ul style="list-style-type: none"> <li>• Students</li> <li>• Sponsors</li> <li>• Alumni</li> <li>• Administrators</li> <li>• Recruiters</li> </ul>	<p>Leverage college development activities</p> <ol style="list-style-type: none"> <li>1. Learning centers (design suite)</li> <li>2. Equipment</li> <li>3. Staff</li> </ol>

Step 5: Top 5 products or assets

1. Students evaluated as job ready
  - a. Exemplary design documentation
  - b. Oral communication skills
  - c. Design skills

2. Products that satisfy clients
3. Capstone course design and delivery
  - a. Facilitation planning
  - b. Performance measures
  - c. Assessment and Evaluation System
  - d. Self directed just in time resources
4. Research papers
5. Graduate student applications
6. Strong vibrant community
  - a. Physical space
  - b. Professional interactions
  - c. Infrastructure (tools and equipment)
  - d. Peer to peer communication
  - e. High expectations
  - f. Meaningful goals

#### Step 6: Key Processes

1. Recruiting Projects
2. Assigning teams
3. Training mentors
4. Facilitation Planning
5. Interfacing with clients

6. Project Management
7. Developing a plan
8. Mentoring Design Teams
9. Product realization cycle
10. Assessing and Evaluating Design Teams
11. Assessing and Evaluating the Course
12. Marketing Capstone

#### What have we learned

1. Seeing future goals as an out growth of current goals
2. Value of the essence statement and stakeholder interests as a validation tool for subsequent steps.
3. Essence statement equals who, what, and how.

#### Step 7: Write Clear Performance Criteria

1. Rigorous
  - a. Strong writing performance
  - b. Improvement oriented
  - c. High expectations for assessment/communication
  - d. Spend more time at high levels of learning (of Blooms Taxonomy)
  - e. Greater breadth expectations
  - f. High performance environment
  - g. High level learning outcomes

Sometime it's sequential, sometimes built around a central core. Rigorous is built around a central core.

Now visualize.

A high performance environment, with clear expectations, strong performance criteria, effective timely assessment, where students perform through writing, research, and teamwork resulting in high level learning outcomes.

## 2. Written and Oral Communication

- a. Clarity
- b. Grammatically correct
- c. Meets needs of target audience
- d. Meets cultural expectations
- e. Should be engaging
- f. Accurate (well researched)
- g. What is intended
- h. Does it have significant impact
- i. Substantial knowledge base

Sequential

Identify an important message, appropriate for audience, medium, undertake a suitable develop process, quality presentation that conforms to expectations of the medium and assess the performance to improve future performance.

{As small short course on learning outcomes

Classification of Outcomes

- i. Competencies
- ii. Movement
- iii. Experience
- iv. Accomplishment
- v. Integrated Performance }

What makes for a strong performance criteria

Identification of significant aspects

Clear and concise

Based around a fluid presentation

Value added

Technically competent

Customer focused

Growth oriented  
Assessment/Continuous Improvement  
Collaborative  
Job ready  
Innovative  
Willing to take risks  
Appealing/from a marketing point of view  
Challenging  
Structured  
Interdisciplinary

Value added  
Technical competent  
    Continuous improvement  
    Assessment  
    Appropriate Risk  
Collaborative  
Innovative

Comment: SEL uses the phrase “what does done look like”. I believe that is the essence of drafting the performance criteria statements.

## Collaborative

- Respectful (quality of participants)
- Supportive (quality of participant)
- Appropriate roles (means)
- Shared vision (hub?) = 2
- Servant leadership (latent hub?)
- Proactive/Engaged (means)
- Aligned efforts (means)
- Mutual understanding of needs/motivation/culture (hub?) = 1
- Appropriate/complementary skill set
- Active Promotion/Marketing (means)

Motivations + Common Vision + Values => Good Implementation  
(proactive, appropriate, aligned, enticing, supportive, empowering)

Collaborative –Respectful, supportive, empowered individuals promoting a mutual understanding of diverse motivations and complementary skills while proactively working towards a shared vision.

Value-added (brainstorm qualities/characteristics/values)

- Community recognition of values and success – defining goals

- Goals – acquires data and demonstrates positive impact
- Holds accountable
- Raw matl + activity = VA
- Better processes
- IMI
- Meaningful activities
- Now => new shows increased performance
- Growth of students, mentors, faculty, clients
- results
  - More valuable roles
  - Improved leadership
  - Improved skill sets
  - Improved learning
- 

Value Added. Community members develop common goals, measure progress toward goal attainment by systematically collecting and analyzing appropriate data that provides convincing evidence that actions are leading to results which have high value to the program and to stakeholders.

Growth oriented (brainstorm qualities/characteristics/values)

- Planning

- Development
- Assessment
- Growth
- Methods
  - Team and community based
  - New => now + plan
  - IMI
  - Current plan => future plan
- Research
  - National trends
  - Current research
  - Idea seeking
  - Benchmarking
- Knowledge
  - Understanding other disciplines
  - Improving knowledge base
  - Connecting missing knowledge
  - Connecting missing links

Growth-oriented – a full understanding of the participant’s current knowledge base allowing the Capstone team to recognize innovative opportunities and methods to elevate performance within program processes, and then implement improved processes that show clear growth and change between a previous state and the current state.

Question for Dan: How do you reduce responsiveness to customer satisfaction? I come from an industry that defines responsiveness as satisfaction and feedback. I.e. there are internal and external customers that have satisfaction and feedback components that are different enough that lumping everything under customer satisfaction increases ambiguity rather than clarity.

Step 8 – Identify key performance measures

Growth-oriented – a full understanding of the participant’s current knowledge base allowing the Capstone team to recognize innovative opportunities and methods to elevate performance within program processes, and then implement improved processes that show clear growth and change between a previous state and the current state

Growth-oriented

- Change in performance – movement
- 

Value Added. Community members develop common goals, measure progress toward goal attainment by systematically collecting and analyzing appropriate data that provides convincing evidence that actions are leading to results which have high value to the program and to stakeholders.

Value added:

- results/deliverables
- presentations/papers
- infrastructure
- hardware + reports
- external validation

Collaborative –Respectful, supportive, empowered individuals promoting a mutual understanding of diverse motivations and complementary skills while proactively working towards a shared vision.

Collaborative:

- Empowered individuals
- Individuals promoting mutual understanding
- Complementary

Template  
for  
Designing your Program Assessment System (PAS) or Unit Assessment System (UAS)

<i>Essence:</i>
<i>Stakeholders:</i>

<i>Scope - What we are:</i>	<i>What we are not:</i>
<i>Current Goals:</i>	<i>Future Goals:</i>
<i>Assets/Products:</i>	<i>Processes/Systems:</i>
<i>Qualities:</i>	
<i>Performance Criteria:</i>	

<i>Criteria</i>	<i>Measure/Attribute</i>	<i>Weight</i>	<i>Means</i>	<i>Instrument</i>	<i>Current</i>	<i>Future</i>	<i>Accountability</i>
Growth Oriented	Individual		Log Books	rubric			
Growth Oriented	Team		Team Binders	rubric			
Growth Oriented	Program		Assessment Report				
Value added	scholarship		paper	Peer review index			
Value added	scholarship		Thesis	qty			
Value added	Project significance		Presentation, interview	External score sheet			
Value added	Project significance		Poster, web	Score sheet			
Value added	External funding		Budget report	Ratio of funds			
Collaborative	“together time”		schedules	qty			
Collaborative	team performance		Team records and artifacts	Team performance rubric			
Collaborative	Project mgmt		Work breakdo + budget	Conformance to plan			
Customer	Stakeholders		Needs	Stakeholder			

focused	quality		analysis	approval			
Customer focused	Product performance		specification	Validation tests			
Technically competent	credibility		Oral Design review	rubric			
Technically competent	Project learning		Written Project report	rubric			
Innovative	creativity		concepts				
Innovative	creativity		processes				
Innovative	Entrepreneurial spirit + mindset						

Example  
of  
Unit Assessment System (UAS)  
New Assessment Office within the OIRA

<b>Essence:</b> promotes an ongoing institutional culture of assessment and monitors the effectiveness of an improving assessment system	
<b>Stakeholders:</b> Students, faculty, staff, administrators, trustees, community members, accreditation organizations, programs, units, District of Columbia, Federal Government	
<p><b>Scope - What we are:</b></p> <ol style="list-style-type: none"> <li>1) We assist in the preparation of reaccreditation reports</li> <li>2) We provide leadership in the ongoing development and the management of a university-wide assessment system</li> <li>3) We provide help in the design of surveys and means of collecting data</li> <li>4) We develop and schedule workshops and provide materials to educate the university community about topics related to assessment</li> <li>5) We are an inclusive, participatory and transparent unit</li> <li>6) We provide assessment feedback on the development and use of assessment systems</li> <li>7) We monitor the progress of</li> </ol>	<p><b>What we are not:</b></p> <ol style="list-style-type: none"> <li>1) We do not design program assessment systems for academic programs (PAS) or administrative units (UAS)</li> <li>2) We do not conduct program reviews</li> <li>3) We are not analysts to interpret survey results</li> <li>4) We do not write annual assessment reports for individual academic program or administrative units</li> <li>5) We do not make institutional decisions or set policy even for assessment practices</li> <li>6) We have no hidden agendas for data collection and there is no evaluation of performance</li> </ol>

assessment system usage	
<p><b><i>Current Goals:</i></b></p> <ol style="list-style-type: none"> <li>1. Create a culture of assessment and continually improving performance in learning, teaching, research, service, and administration throughout the university</li> <li>2. Facilitate the formation and functioning of PAS and UAS for every academic program and administrative unit</li> <li>3. Set performance expectations for quality in PAS and UAS</li> <li>4. Provide professional development activities for the university community to strengthen assessment</li> <li>5. Assist in the integration and alignment of the assessment systems and processes with other university systems and processes</li> <li>6. Assess current PAS and UAS to improve their quality in implementation</li> </ol>	<p><b><i>Future Goals:</i></b></p> <ol style="list-style-type: none"> <li>1. To develop a meta- assessment system for the university that aligns institutional measures of effectiveness, strategic plans, operational plans, functional unit assessment systems, and program assessment systems into annual budgeting and decision making processes</li> <li>2. To bring every academic program and administrative unit in the university to a point where it has an ongoing effective PAS or UAS for the improvement of learning, teaching, research, service, and administration leading to greater university effectiveness</li> <li>3. To have every academic program and administrative unit produce annual assessment reports</li> </ol>

<p><b><i>Assets/Products:</i></b></p> <ol style="list-style-type: none"> <li>1. An improving meta-assessment system</li> <li>2. Self-study report</li> <li>3. PAS and UAS training Process</li> <li>4. An Improving Assessment Manual</li> <li>5. A Blackboard Site for Assessment</li> <li>6. Flashlight Software System</li> <li>7. Facilitators for workshops and consulting</li> <li>8. Core number of PAS and UAS as models for other academic programs and administrative unites</li> <li>9. Measures of Institutional Effectiveness and supporting documentation</li> <li>10. Unit Assessment System for Academic Affairs</li> </ol>	<p><b><i>Processes/Systems:</i></b></p> <ol style="list-style-type: none"> <li>1. <b>Design:</b> Provides the design manual, templates, workshops, assessment, and coaching for the development, implementation, and on-going improvement of PAS and UAS systems</li> <li>2. <b>Professional Development:</b> coordinate workshops, seminars, and personal interactions on an annual time-frame to continually advancing assessment practice</li> <li>3. <b>Communication:</b> Communicates assessment practices throughout the university at the classroom level, course level, program and unit level, and at the university level through email, phone mail, Blackboard postings, UDC Spark, University newspapers, and website</li> <li>4. <b>Collaboration:</b> encourages team participation by broad segments of the university community students, faculty, staff, administrators, alumni, and community members to be involved in the on-going assessment efforts</li> <li>5. <b>Facilitation:</b> Constantly is seeking out areas that need help, setting up means for advancing designs, bringing in local stakeholders, building consensus, assessing forward movement, and finally helping them bring designs into practice.</li> <li>6. <b>Monitoring:</b> Setting up a means for inventorying all academic programs and administrative units to be able to follow their design, development, implementation, improvement of both their PAS or UAS and their annual assessment reports.</li> </ol>
<p><b><i>Qualities:</i></b></p> <p>Transparent  Improvement oriented  Systematic  Servant leadership  Communicative  Collaborative  Inclusive</p>	

<b>Performance Criteria:</b>	
<b>Transparent:</b>	Assessment office provides processes, systems, and information that are unbiased, easily accessible, and provides access to the results of the assessment efforts for all community members
<b>Improvement oriented:</b>	Facilitates an extensive ongoing dialog of how to improve the campus quality through a diverse set of assessment practices and systems, improved processes, better analyses, and a strong commitment to help each other strengthen our respective academic programs or administrative units.
<b>Systematic:</b>	Constantly promoting an advanced understanding and implementation of the value of assessment through identifying and aligning appropriate measures, systematic processes, annual documentation of accomplishments and action plans and the use of this feedback into budgetary decision making and strategic planning
<b>Servant leadership:</b>	Assessment office is service-oriented, committing extensive time, energy, and talents to facilitate and engage the entire community in assessment practice for continuous quality improvement
<b>Communicative:</b>	Articulates and communicates a consistent clear vision of the assessment initiative and the institutional commitment through constant formal and informal communications that is supported with a growing expertise, expanding resources, and aligned strategic planning
<b>Collaborative:</b>	Engages with each academic program and administrative unit in a collaborative mode to help assist in understanding assessment mindset, principles, design, implementation, and documentation that will help the program advance in quality and development
<b>Inclusive:</b>	Assessment office has the most available access with regards to its resource allocation, support, informational materials, models, blackboard postings, and personnel

<b>Criteria</b>	<b>Measure</b>	<b>Weight</b>	<b>Means</b>	<b>Instrument</b>	<b>Current</b>	<b>Future09</b>	<b>Accountability</b>
Transparent	Accessibility	15%	Blackboard	Ratio of systems posted and annual assessment reports	Modeling it PAS/UAS 24/600 AAR 1/600	PAS/UAS 400/600 AAR 350600	Marie
Transparent	Forthcoming	10%	Blackboard	Scoring Sheet 1 (average)			Marie
Improvement oriented	Quality of Annual	10%	Blackboard	Scoring sheet 1 of the quality			Marie

	Assessment Reports						
Systematic	Alignment	5%	Blackboard	Scoring sheet 1			Marie
Systematic	Consistency	5%	Blackboard	Scoring sheet 1			Marie
Systematic	Timeliness	10%	Log of Posting	Number of days late			Marie
Servant leadership	Satisfaction	10%	Client Survey	Index of Satisfaction			Marie
Communicative	% of People Informed	10%	Phone survey of new employees 1 year after arriving	Number count in %			Marie
Communicative	Knowledge of Assessment	10%	On-line test taken by random sample of faculty and staff	Average test score			Marie
Collaborative	Satisfaction	5%	Client Survey	Index of Satisfaction			Marie
Inclusive	% of Implementation	10%	Blackboard	Ratio of systems posted and annual assessment reports			Marie

ANNUAL ASSESSMENT REPORT (write every May) => 2-8 hrs

Attractive graphic on cover

Inside cover (steps 1-6)

3<sup>rd</sup> Page on => one page for each performance criteria (most to least important)

- Major accomplishments (04-05); 2-3 sentences each
- Other accomplishments; list format
- Activities; list format in columns
- Action Items for next year
- Future Action Items

Assess program assessment process

Calendar of activities for 05-06 => inform stakeholders

**ACTION PLAN FOR CAPSTONE TEAM**

3 hr capstone team session – BEFORE THANKSGIVING  
complete process documentation (steps 1-8; 12-15)

1 hr effort/performance criteria – OVER THANKSGIVING

Assign performance criteria to different individuals to draft page for assessment report

1.5 hr team session – WEEK AFTER THANKSGIVING

review contributions and assess CQI within program

2 hr effort – BY END OF TERM

Editor synthesizes meeting outcomes and drafts report

2 hr effort – FIRST WEEK OF SPRING SEMESTER

Focus group SII assessment with Don Blacketter, Howard Peavy, Karen Den Braven, Chris Manning, WSU engineering colleagues, UI Ag & Bio Engineering Colleagues to assess the report

1 hr effort – FIRST WEEK OF SPRING SEMESTER

Finalize 1<sup>st</sup> report based on feedback from peer assessment => to be utilized during session with capstone advisory group in May

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