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Design and Implementation of a Program Outcome Assessment Process for an ABET-accredited Computer Engineering Program

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Assessment Plan

Program Outcomes	Course-Embedded	Senior Design Project Rubric	Student Course Survey	Graduating Student Survey
(a) An ability to apply knowledge of mathematics, science, & engineering.	EECS 111		X	X
(b) An ability to design and conduct experiments as well as analyze and interpret data		X	X	X
(c) An ability to design a system to meet desired needs.		X	X	X
(d) An ability to function on multidisciplinary teams		X	X	X
(e) An ability to identify, formulate, and solve engineering problems.	EECS 115		X	X
(f) An understanding of professional and ethical responsibility.	EECS 129		X	X
(g) An ability to communicate effectively.		X	X	X
(h) A broad education necessary to understand impact of engineering solutions in a global/societal context	GED	X	X	X
(i) Recognition of the need for and ability to engage in lifelong learning.	EECS 115		X	X
(j) Knowledge of contemporary issues.	EECS 115		X	X
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	EECS 115		X	X
(l) Knowledge of probability and statistics, including applications to computer engineering.	EECS 140		X	X
(m) Knowledge of mathematics, and basic and engineering sciences, necessary to carry out analysis and design appropriate to computer engineering.	EECS 115		X	X
(n) Knowledge of discrete mathematics.	EECS 140		X	X
	Direct		Indirect	

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Assessment Schedule

Assessment Tool	Respondents	Schedule	Analysis	Review process
Course-embedded assessment	Students enrolled in each course	Every quarter	Every quarter	Instructor review
	Faculty (FCARs)		Once a year	Undergraduate committee review
Senior design project	Seniors	Once a year (end of senior year)	Once a year	Undergraduate committee review
Course surveys	Students enrolled in each course	Every quarter	Every quarter	Instructor review
Graduating student survey	Graduating Seniors	Once a year (end of senior year)	Once a year	Undergraduate committee review

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Curriculum Map

I = introduced, R = reinforced, and A = assessed.

Core courses	a.	b	c.	d	e.	f.	g.	h..	i..	j.	k.	l.	m.	n.
Math 6A														I
EECS 12 Introduction to Programming		I	I											
EECS 20 Computer Systems and Programming in C			I		I									
EECS 31 Introduction to Digital Systems	I	I	I		I									R
EECS 31L Introduction to Digital Logic Laboratory		R	R		R	I	I		I	I	I			R
EECS 40 Object-Oriented Systems and Programming		R	R											
EECS 70A Network Analysis I	R		R											
EECS 70B Network Analysis II	R		R											
EECS 70LB Net. Analysis II Lab		R	R	R	R									
EECS 111 System Software	A	R	R		R			R			R	R	R	R
EECS 112 Organization of Digital Computers		R		R	R	R		R						
EECS 112L Architecture Lab		R	R	R	R	R			R					
EECS 114 Engineering Data Structures and Algorithms	R	R	R		R							R		R
EECS 115 Intro to VLSI	R	R	R		A			R	A	A	A	R	A	R
EECS 129/129A Senior Design Project		A	A	A	R	A	A	A	R	R				
EECS 140 Engineering Probability	R	R	R									A	R	A
EECS 150A Continuous-Time Signals and Systems	R		R											
EECS 150B Discrete-Time Signals and Systems I	R	R	R											
EECS 170A Electronics I	R		R						R					
EECS 170LA Elect I Lab		R	R	R					R	R				
EECS 170B Electronics II		R	R	R										
EECS 170LB Elect II Lab	R	R	R	R		R	R		R					
General education courses								I,R,A						

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Faculty Course Assessment Report (FCAR)

- Used for assessing either Course Outcomes or Program Outcomes

PO(e). An ability to identify, formulate, and solve engineering problems.			
Assessment Method	***Average Score***	***%Meeting Performance Standards***	***Performance Standard***
HW1 through HW6	89/100	91%	70%
Midterm P5	21.52/25	82%	18/25
Midterm P6	2.46/5	57%	2/5
Final Q5	6.22/10	78%	6/10
Final Q6	5.4/10	60%	5/10

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Scoring Rubric (Partial) (Adapted from U. Pitt.)

Outcomes	Exemplary(4)	Proficient(3)	Apprentice(2)	Novice(1)	Score*
Program Outcome 3: An ability to design a system to meet desired needs.					
3.1 Identify specific project objectives based on project and client requirements.	All important project objectives are identified.	All important objectives are identify but 1 or 2 minor ones are missing.	Most objectives are identified but at least 1 or 2 important ones are missing.	Most or all important objectives not identified	
3.2 Gather and use relevant background data	All relevant information is obtained and used to support design recommendations.	Sufficient information is obtained and used to support design recommendations.	Some information is obtained but more is needed to support design recommendations.	No significant background information is gathered.	
3.3 Generate and analyze alternative solutions by synthesizing and applying appropriate engineering knowledge	Three or more alternative solutions are considered; each is correctly analyzed for technical feasibility.	At least 3 alternative solutions are considered; analysis is complete but contains minor procedural errors.	At least 2 alternative solutions are considered; analysis contains minor conceptual and/or procedural errors.	Only one solution considered; no optimization included; better solutions were available.	
3.4 Consider all relevant constraints if applicable					
Economic	All economic issues included; computations are correct.	Important economic issues correctly included; minor ones may have been ignored.	One or more important considerations ignored; but computations correct.	Most if not all economic considerations ignored; and/or computations flawed.	
Environmental, sustainability	Environmental factors, sustainability adequately considered.	Important issues considered; certain minor ones may have been ignored.	One or more important issues ignored.	Most if not all issues ignored.	
Manufacturability	If applicable, thoroughly considered.	Important issues considered if applicable.	Certain important issues ignored.	Most if not all important issues ignored.	
Ethical, health and safety	Ethical issues including safety of public and work health considered.	Primary issues considered; one or two secondary issues may have been ignored.	Most but not all important issues considered.	Most if not all important issues ignored.	
Social/political	Problem placed in appropriate social/political context; all issues considered.	Primary issues considered; some secondary issues may have been neglected.	Most but not all primary issues considered.	Most if not all primary issues ignored.	
3.5 Choose the best solution based on technical and economic criteria and considering other relevant constraints	Best solution is recommended based on stated criteria and constraints.	Reasonable solution is recommended; other alternatives should have been developed and analyzed.	Satisfactory solution is recommended; better solutions were available and should have been considered.	Only one solution considered; better solutions were available; most constraints ignored.	

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Updating Program Outcomes

- Input from key constituents (survey 3/06):
  - Practitioners in industry (including alumni),
  - Practitioners in industry who supervise our alumni, and
  - Faculty from engineering graduate programs who advise our alumni

- 13 out of 14 POs deemed appropriate

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Assessment Results

Program Outcomes	Course-embedded Assessment (FCARs) *(Direct)*	Senior Design Project Rubric *(Direct)*
(a) An ability to apply knowledge of mathematics, science, and engineering.	79.8%	
(b) An ability to design and conduct experiments as well as analyze and interpret data		86.0%
(c) An ability to design a system to meet desired needs.		86.0%
(d) An ability to function on multidisciplinary teams		100%
(e) An ability to identify, formulate, and solve engineering problems.	82.0%	
(f) An understanding of professional and ethical responsibility.	87.5%	
(g) An ability to communicate effectively.		93.0%
(h) A broad education necessary to understand impact of engineering solutions in a global/societal context	93.0%	
(i) Recognition of the need for and ability to engage in lifelong learning.	91.0%	
(j) Knowledge of contemporary issues.	65.0%	
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	86.0%	
(l) Knowledge of probability and statistics, including applications to computer engineering.	70.3%	
(m) Knowledge of mathematics, and basic and engineering sciences, necessary to carry out analysis and design appropriate to computer engineering.	74.0%	
(n) Knowledge of discrete mathematics.	72.8%	

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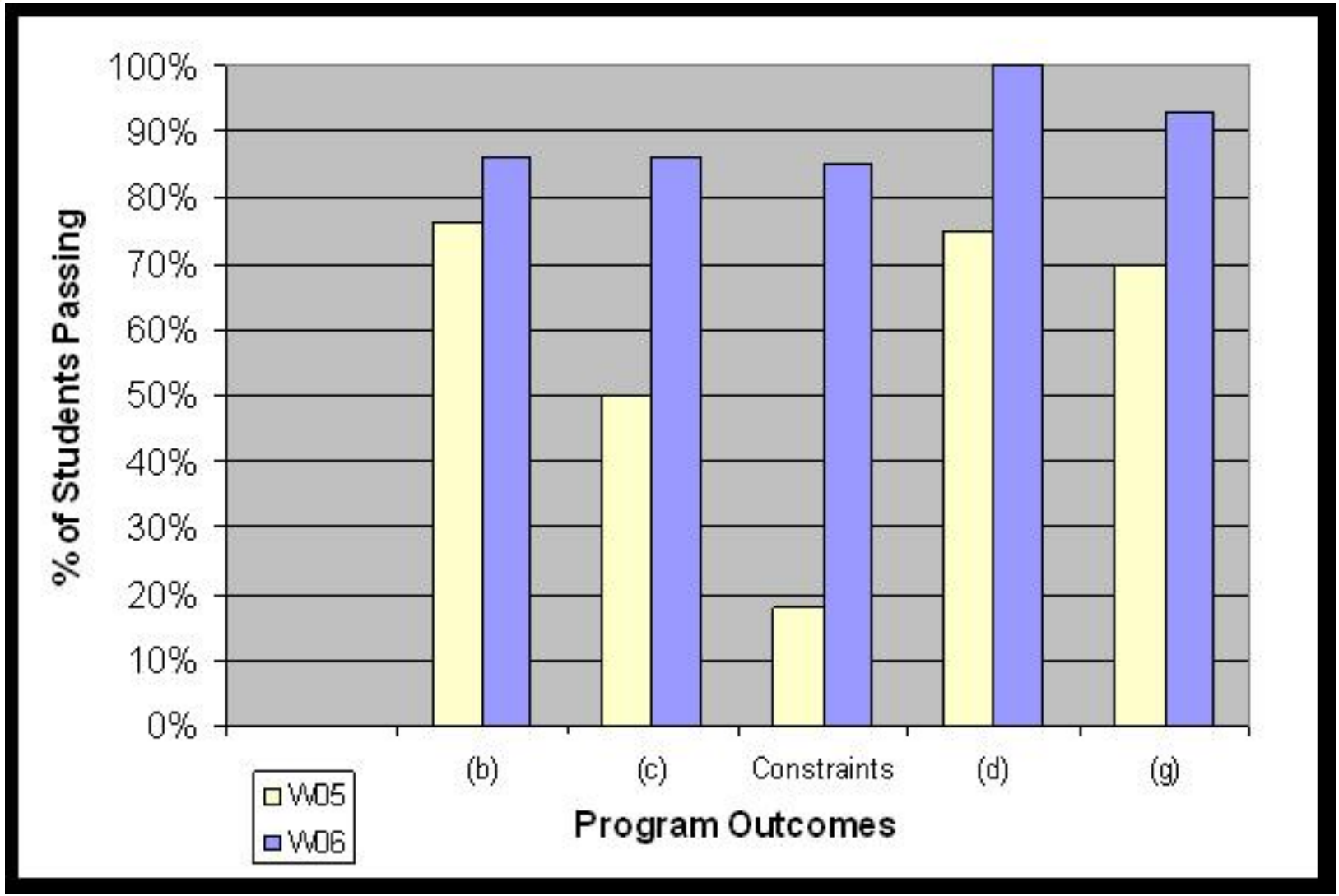
Improvement



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Future Improvements for Senior Design Project

- Two quarter sequence
- Individual faculty involvement
- Industry involvement in EXPO

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Conclusion

- PO Assessment process for ABET Criterion 3
- Shows improvement in % students meeting POs.
- Continual process