Culture of Disengagement in Engineering Education?

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Professional Culture of Engineering

- Professional Culture = rich and historically-rooted **meaning system** built into and around engineering's tasks and knowledge.

- How do cultural beliefs in engineering create challenges for infusing ethics?

Engineering Ethics and Public Welfare

Engineers hold paramount the safety, health and welfare of the public in the performance of their professional duties...should engineers' professional judgment be overruled under circumstances where the safety, health and welfare of the public are endangered, the engineer shall inform their clients or employers of the possible consequences and notify other proper authority of the situation.

--Section I.c of the “Code of Ethics for Engineers,” Engineers’ Council for Professional Development

Engineering Ethics and Public Welfare

- Engineering's professional responsibilities emerge out of their social and legal monopoly on an entire area of life.

- The way engineers understand their role in society impacts their designs (e.g., via problem definition; definitions of successful engineering)

- The lay public is increasingly reliant on engineers to be ethics and public welfare watchdogs.

If engineers do not reflect on the broader ethical and social impacts of their technologies, *who will?*

Engineering education is the only institutionalized training where future engineers learn the ethics and responsibilities of their profession.

Do engineering students become **more** concerned about ethical and public welfare considerations over time?

1. Do views change over their education?
2. Do their programs emphasize engagement?
3. Do program emphases affect students views?

Data

- Longitudinal Panel Sample,
  - Freshman -> 18 months post-graduation
- N=326

Data

- Questions:

  What, in your opinion, makes a <u>successful career</u>? (1=very unimportant to 5= very important to a successful career)

  1. **Professional and Ethical Responsibilities**
  2. **Understanding the Consequences of Technology**
  3. **Understanding how People Use Machines**

  How important are the following to you personally? (1=very unimportant to 5= very important)

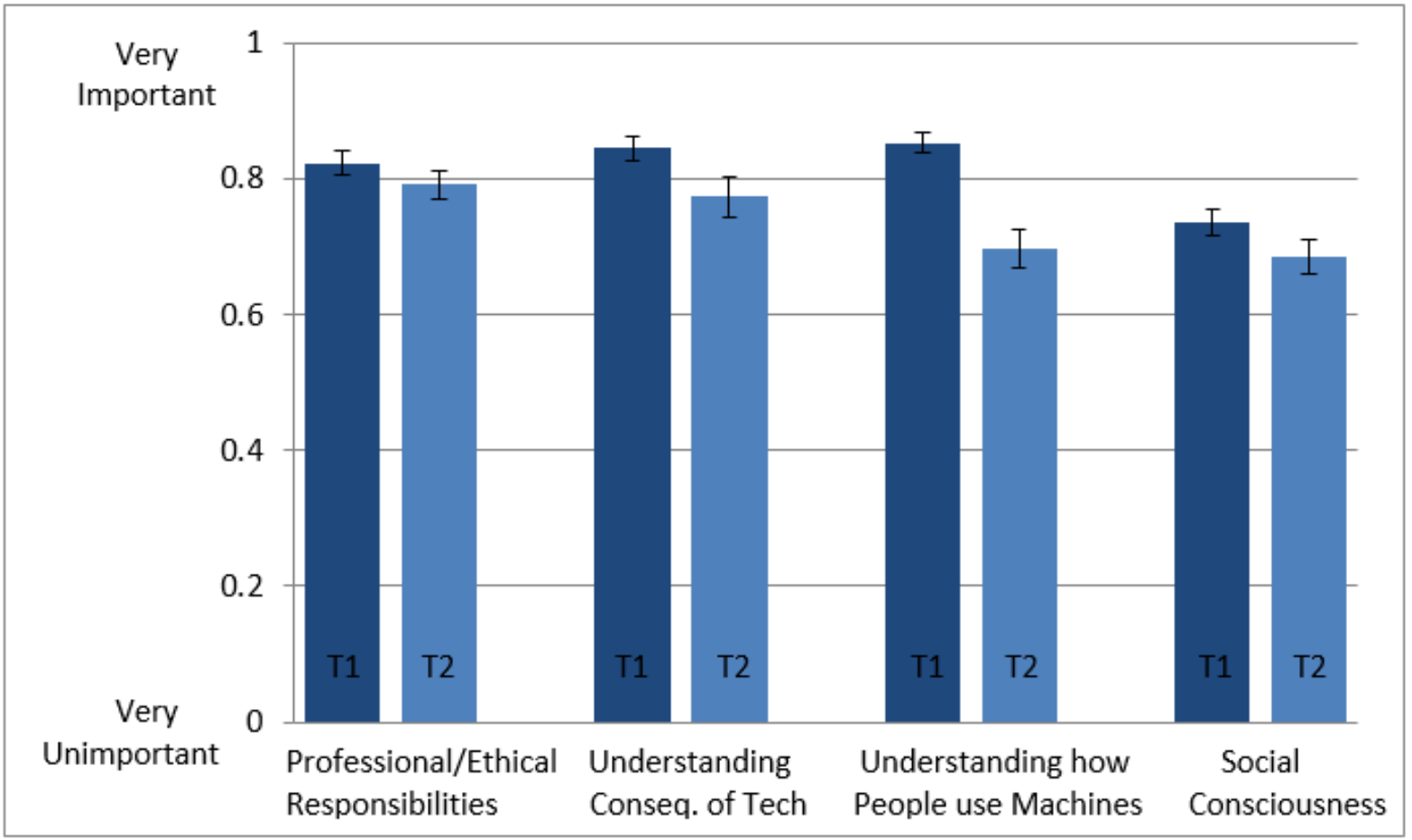
  - Improving Society
  - Being Active in my Community
  - Promoting Racial Understanding
  - Helping Others in Need

  4. **Social Consciousness Scale**
     (alpha=.788)

1. Do Students Become More Concerned with Ethical & Public Welfare Issues?

Figure 1: Public Welfare Beliefs among Engineering Students, Time 1 and Time 2

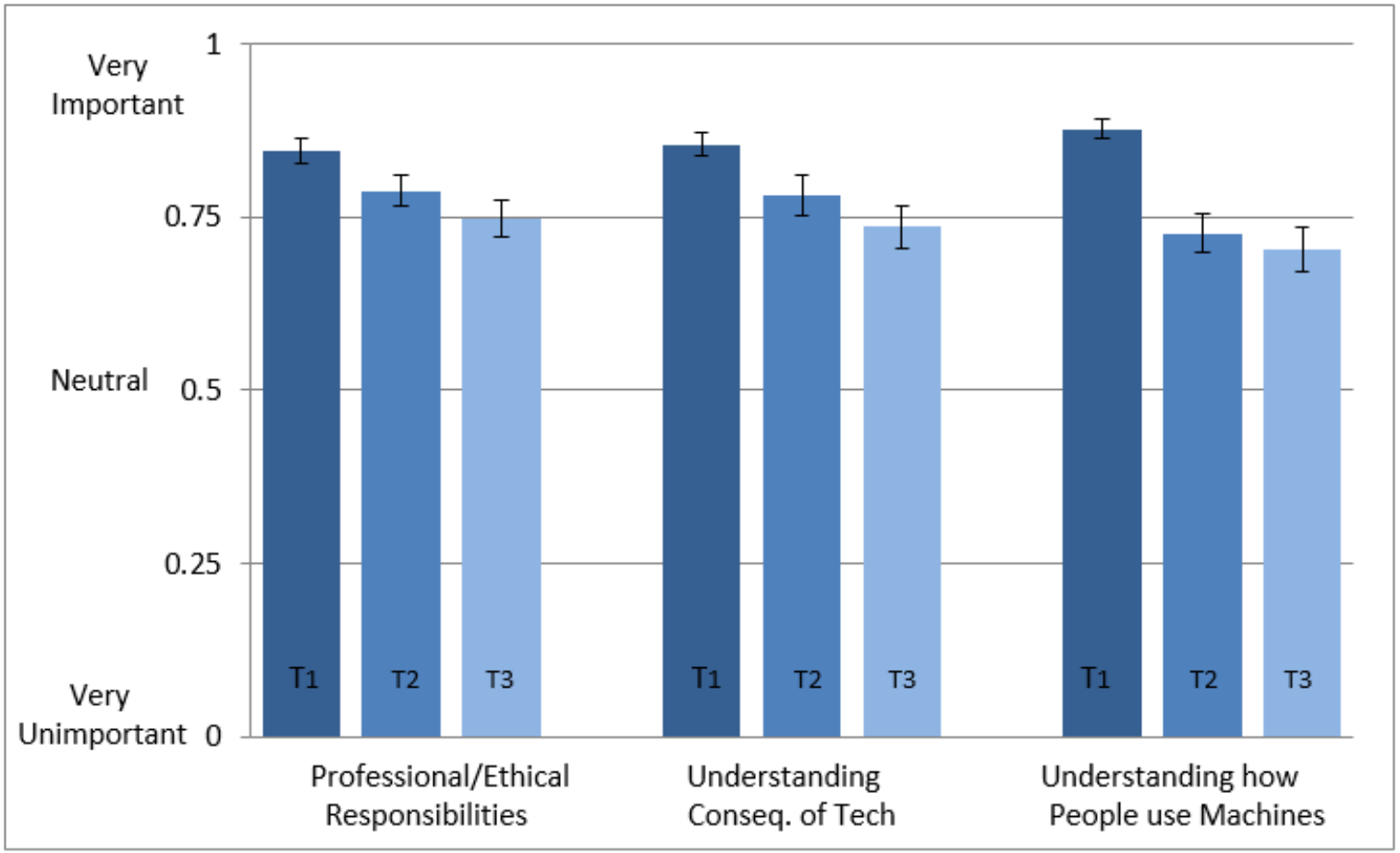


Notes: Each bar represents the mean value on that measure at time 1 (dark bar) and time 2 (lighter bar). Means were scaled to a 0 to 1 range as follows: social consciousness measure: ([mean-1]/4); the remaining three public welfare beliefs: ([mean-1]/5).

(Cech 2014)

1a. Do ethics and public welfare beliefs rebound once in the workforce?

Figure 3: Public Welfare Beliefs in Time 1, Time 2, and Post-Graduation Work (Time 3), among Engineering Students who Enter Engineering Jobs

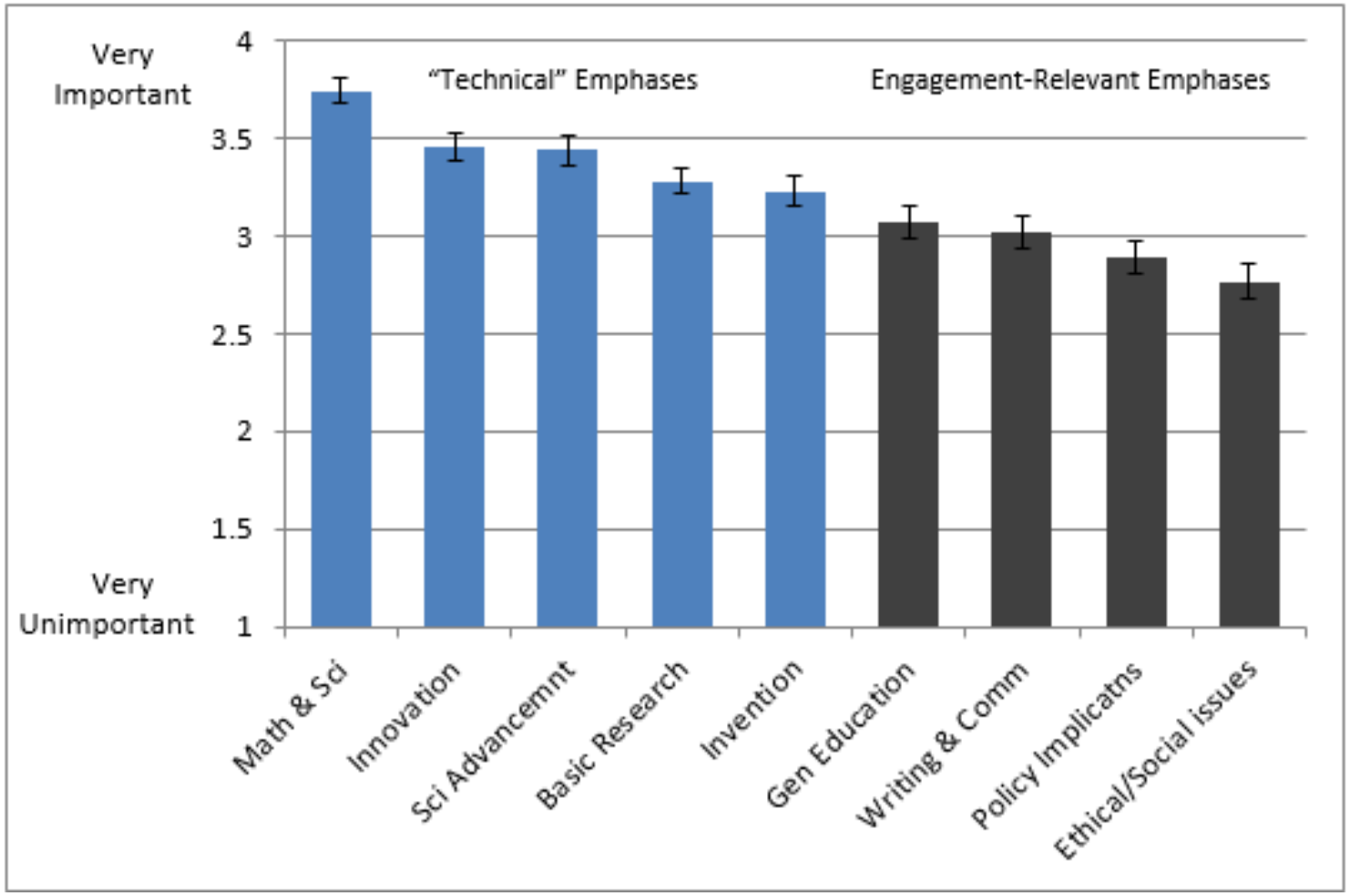


Notes: Each bar represents the mean value on that measure at time 1 (darkest bar), time 2 (middle bar), and time 3 (lightest bar). Only those students who graduated and went on to enter an engineering job are included in these values. Means on all values were scaled as follows: ([mean-1]/5).

(Cech 2014)

2. Do Engineering Programs (De)emphasize Public Welfare and Ethics Concerns?

Figure 2: Cultural Emphases of Students' Engineering Programs, Measured at Time 1



(Cech 2014)

3. Do Programmatic Emphases Impact Student Concerns for Public Welfare and Ethics?

Engineering Students' Public Welfare Beliefs (Time 2)

Cultural Emphases of Engineering Program (Time 1)	Professional/Ethical Responsibilities	Understanding the Consequences of Tech	Understanding how People Use Machines	Social Consciousness
Ethical/Social Issues	.255** *(.080)*	.348*** *(.078)*	.295** *(.092)*	.264*** *(.069)*
Policy Implications of Engineering	.190* *(.085)*	.201† *(.109)*	.146 *(.090)*	.161* *(.073)*
General Education	.187† *(.100)*	.373** *(.111)*	.156 *(.112)*	.260*** *(.066)*
Writing Skills	.183† *(.096)*	.346** *(.107)*	.203† *(.110)*	.068 *(.073)*

Culture of Disengagement

A constellation of beliefs, meanings and practices that frame ethical and public welfare concerns as tangential to “real” engineering.

- What it means to “think like an engineer”
- What counts as legitimate information for defining/solving problems
- What “successful” engineering looks like

Culture of Disengagement

Depoliticization

Technical/Social Dualism

Meritocratic Ideology

Culture of Disengagement

Depoliticization

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Depoliticization:
Cultural and social concerns are irrelevant to "real" engineering work; *can* and *should* be bracketed out.

Culture of Disengagement

Depoliticization

Technical/Social Dualism

Meritocratic Ideology

Technical/Social Dualism:
Dualistic separation of "technical" and "social" tasks and skills; devaluation of the "social"
(Faulkner 2007)

Culture of Disengagement

Depoliticization

Technical/Social Dualism

Meritocratic Ideology

Meritocratic Ideology:

The belief that success is the result of individual talent, training, and motivation; failure is simply a lack thereof.

How to (Re)Engage Students?

- Validate topics of ethics and public welfare

- Incorporate ethics considerations into “purely technical” courses

Silver lining: cultural emphases of programs do influence students. Re-engagement can start with engineering programs.

Thank you

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Based on:
Cech, E. A. 2014. “Culture of Disengagement in Engineering Education?” *Science, Technology & Human Values.* 39(1):42-72.

Table 1: Means and Standard Errors for Variables of Interest (N=326)

	Mean	*Std. Err.*
Female (*1=yes)*	.466	*.028*
Attended Olin (*1=yes)*	.169	*.021*
Attended Smith (*1=yes)*	.144	*.019*
Attended Umass (*1=yes)*	.135	*.019*
Attended MIT (*1=yes)*	.552	*.028*
Hispanic (*1=yes)*	.077	*.015*
African-American (*1=yes)*	.065	*.014*
Asian/Asian-American (*1=yes)*	.231	*.023*
Family Income (in $10,000 increments)	9.900	*.363*

(Cech 2014)

Table 2: OLS Regression Models Predicting Public Welfare Beliefs at Time 2 with Demographic Measures

	Professional/Ethical Responsibilities		**Understanding the Consequences of Tech**		**Understanding How People Use Machines**		**Social Consciousness**	
	Unst. Coeff	*S.E.*	Unst. Coeff	*S.E.*	Unst. Coeff	*S.E.*	Unst. Coeff	*S.E.*
Female	.185	*.117*	.231†	*.137*	.058	*.159*	.293**	*.098*
Olin	.065	*.156*	-.006	*.171*	.007	*.194*	.115	*.114*
Smith	**.520***	*.210*	-.072	*.224*	-.104	*.250*	.076	*.171*
Umass	.219	*.188*	-.032	*.207*	.118	*.242*	.052	*.131*
Hispanic	.159	*.212*	.122	*.266*	-.107	*.246*	.154	*.179*
African-American	.071	*.294*	.389	*.322*	-.299	*.332*	.306	*.198*
Asian	.056	*.145*	-.238	*.155*	-.332*	*.166*	.028	*.115*
Family Income	-.006	*.009*	-.001	*.010*	.006	*.011*	-.007	*.007*
Constant	4.011***	*.146*	3.809***	*.167*	3.513***	*.185*	2.596***	*.112*
F-statistic	2.07*		.510		.670		2.22*	

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Table 3: OLS Regression Models Predicting Change in Public Welfare Beliefs (Time 1 to Time 2) with Demographic Measures

	Professional/Ethical Responsibilities (T2)		Understanding the Consequences of Tech (T2)		Understanding How People Use Machines (T2)		Social Consciousness (T2)	
	Unst. Coeff	*S.E.*	Unst. Coeff	*S.E.*	Unst. Coeff	*S.E.*	Unst. Coeff	*S.E.*
Female	.122	*.118*	.165	*.129*	.131	*.165*	**.167†**	***.088***
Olin	.043	*.153*	-.021	*.167*	.033	*.193*	.036	*.100*
Smith	***.457****	***.208***	-.039	*.217*	-.112	*.246*	.069	*.153*
Umass	.167	*.183*	-.045	*.198*	.138	*.240*	.172	*.114*
Hispanic	.170	*.209*	.050	*.259*	-.064	*.249*	.105	*.162*
African-American	.028	*.290*	.331	*.319*	-.295	*.331*	.048	*.186*
Asian/Asian-American	.056	*.146*	**-.265†**	***.146***	**-.326†**	***.167***	.067	*.106*
Family Income	-.008	*.008*	-.001	*.010*	.005	*.011*	-.004	*.006*
Constant	2.898***	*.392*	2.146***	*.474*	2.125**	*.652*	1.068***	*.216*
T1 Prof/Ethical Responsibilities	.276**	*.086*						
T1 Underst. Consequences of Tech			.390***	*.099*				
T1 Underst. People Use Machines					.316*	*.134*		
T1 Social Consciousness							.533***	*.063*
F-statistic	3.19**		2.84**		1.37		10.88***	

Note: *** p<.000 ** p<.01 * p<.05 † p<.10 (two-tailed test); MIT is reference category for school; white is reference category for race/ethnicity;
Including the time 1 measure of the independent variable while predicting the time 2 value of that variable effectively indexes the change in that variable over t

(Cech 2014)