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Impacts and Professional Obligations to Society: Preparing Geomatics Engineers for the 21st Century

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Geomatics Engineering Education - a time to …

Develop Values and Professional Identity

"Engineers are assumed to develop their professional commitment to public welfare through (their) engineering education" [1]

"Graduates from our program should be equipped for life long learning; to continue to learn and contend with technical, social, political and economic change, and make meaningful contributions to society throughout the course of their lives."

(Geomatics Engineering Values and Principles, Department of Geomatics Engineering, University of Calgary)

Holistic Thinking

What it is?

Ability to ”manage, lead, understand” in multiple dimensions: economic, social, environmental, policy, etc. [6,7]

Canadian Engineering Accreditation Board (CEAB)

Graduate Attributes

3.1.8 **Professionalism:** An understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.

3.1.9 **Impact of engineering on society and the environment:** An ability to analyze social and environmental aspects of engineering activities. Such ability includes an understanding of the interactions that engineering has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions; and the concepts of sustainable design and development and environmental stewardship.

3.1.10 **Ethics and equity:** An ability to apply professional ethics, accountability, and equity.

[2]

3 of 12 Grad Attributes
(25% of Grad Attributes)

Australian Engineering Attributes (Engineers Australia)

Graduate Attributes

g) understanding of the social, cultural, global and environmental responsibilities of the professional engineer, and the need for sustainable development

h) understanding of the principles of sustainable design and development

i) understanding of professional and ethical responsibilities and commitment to them

[3,4]

3 of 10 "Generic" Grad Attributes

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Important to Graduate Attributes

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Important to Graduate Attributes

Call for social dimension and holistic thinking for engineering education programs; 25% or more of attributes are related to social dimension.

What it is?

Ability to ”manage, lead, understand” in multiple dimensions: economic, social, environmental, policy, etc. [6,7]

Important to Graduate Attributes

Call for social dimension and holistic thinking for engineering education programs; 25-30% of attributes related to social dimension

Are we ready?

- Social dimensions of engineering often taught in stand-alone, one-off courses
- Engineering students have issues connecting from one course to another [8]
- Some studies show decrease in connection with society over engineering program (Culture of Disengagement) [1]

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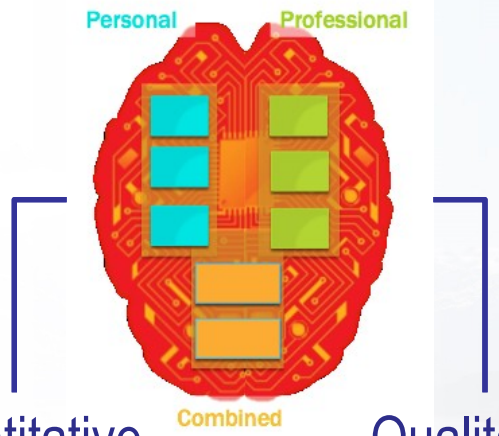
Next Steps

Development of Social Responsibility via Community Engagement

Measuring Social Responsibility

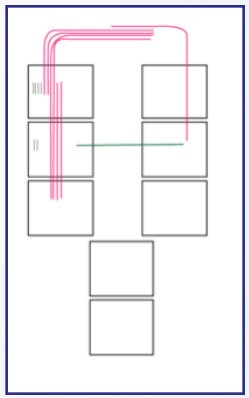
PSRDM Model



Quantitative

Qualitative

EPRA Assessment Tool



- EPRA and PSRDM (Dr. Nathan Canney, [9])
  - EPRA is a survey/assessment that measures SR development in relation to the PSRDM model
  - EPRA "Engineering Professional Responsibilities Assessment" for quantitative measures
  - PSRDM "Professional Social Responsibility (SR) Development Model" used for qualitative responses
  - Validated and Tested model and framework
- 3 Related Canadian Graduate Attributes (Brennan, Hugo[10])
  - Professionalism, Ethics & Equity, Impact on Society

What educational activities support development of social responsibility?

- Community Engagement
  - Capstone design project
  - Problem framing
  - Global experiences
  - Co-curricular

Community Engagement - Fourth Year Engineering Design Course

Where: University of Calgary, 2015/2016

What: Provide 4th year opportunities that are for non-profits and compare SR development with those with industry and academic clients.

Objective: To explore social responsibility development and social graduate attributes.

Method:

- Pre-post (September & April)
- Social Responsibility framework (PSRDM) and corresponding survey (EPRA) [9]
- Canadian graduate attribute measurement [10]

How does your project help you understand your role and connection to society? (Initial Responses)

…experience the development of an idea based on its potential to impact society in a positive way, and to build this idea into a tangible item. In doing so, I was able to see the impact the knowledge I obtained during my degree can have. […] four years of education put into the engineering degree can be applied in the real world, and I can be a contributing member to society. [Geomatics Student]

That engineers are simply a very small cog in a very large wheel. Our work is not revolutionary and we are just completing projects for a goal that was not chosen by us. If we did not make our sponsor happy our work was irrelevant.

Conclusion

Social responsibility/ Holistic thinking

Aiming to tackle the "Culture of Disengagement" [1]

Increasing the ability for students to read engineering problems with "multiple layers of meaning" – in a holistic manner [6,7]

What can engineering educators do?

Provide opportunities for community engagement, especially in co-curricular, or design courses.

Evoke thoughts on social dimensions of engineering through use of reflection assessment techniques in technical and non-technical courses.

Next Steps

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Social Responsibility
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THANK YOU!

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What are the "Grad Attributes"?

- Measuring "outcomes" of learning (instead of "inputs") are the new direction of higher education
- Grad "attributes" can be thought of as "outcomes" of learning
- Engineering Accreditation boards (Canadian, American, Australian, etc.) have specified the "outcomes" (or learning goals) for accredited engineering programs
- Current engineering education research and literature revolves heavily around how to development these attributes/outcomes and how to measure these attributes/outcomes.

Pilot Project: In Co-curricular, Voluntary

Where: University of Calgary, 2015 - Homes of Hope Spring Break Trip

What: Week long Engineering volunteer opportunity, to go to Mexico on spring break and build homes

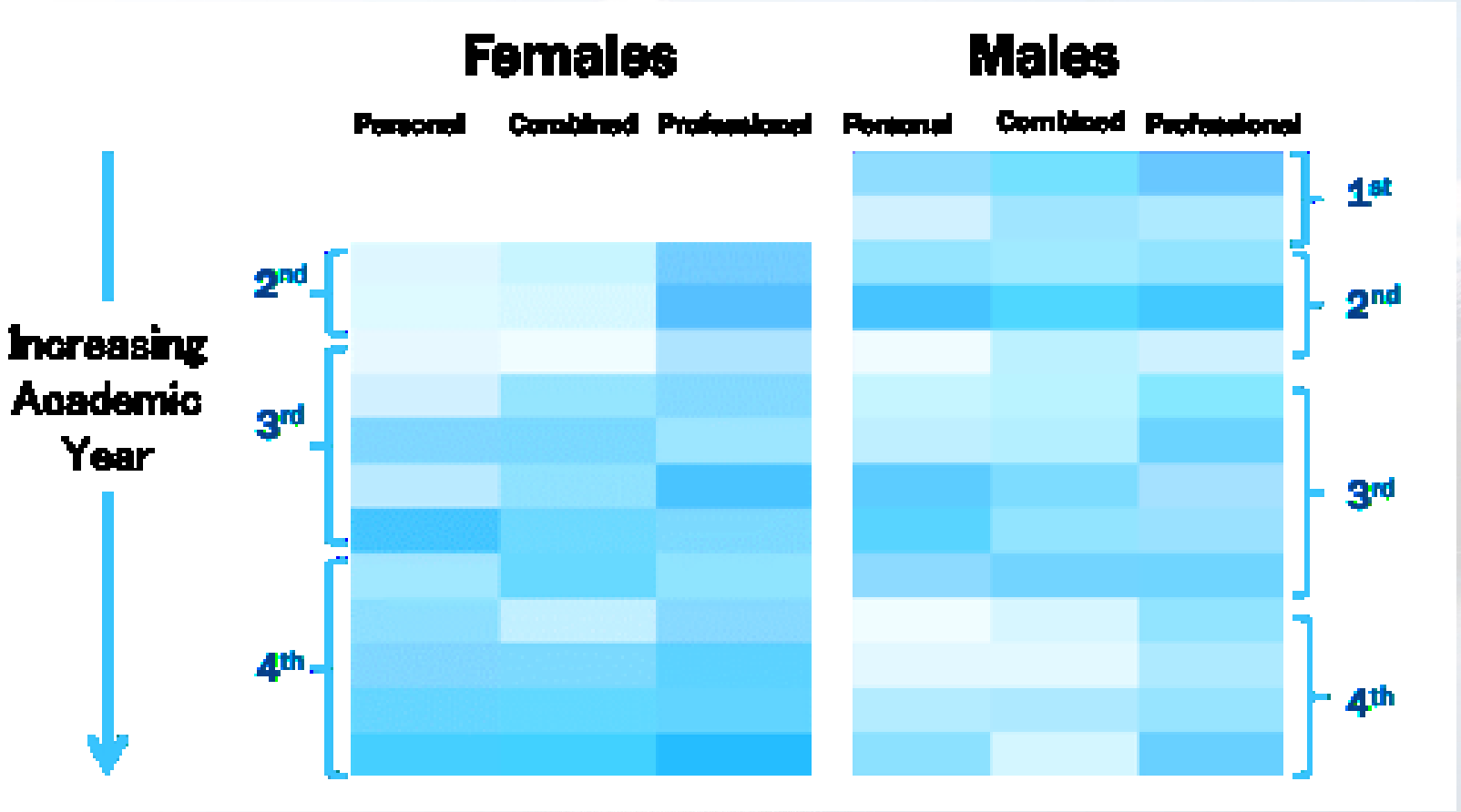
Objective: Practice and explore the use of PSRDM, EPRA (Social Responsibility Measurement Tools) to measure SR development for a short, voluntary community engagement experience.

Method:

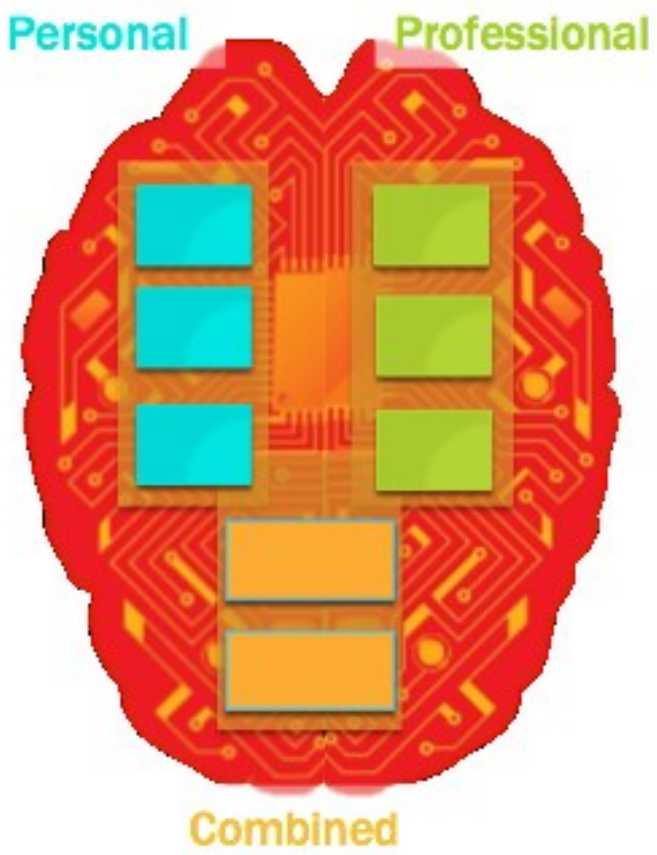
[14]

- Pre-post, mixed methods research
- Social Responsibility framework (PSRDM) and corresponding survey (EPRA) [10]
- Canadian graduate attribute measurement

Results from EPRA/SR Measures:



What is PSRDM framework?



- PSRDM = "Professional Social Responsibility (SR) Development Model"
- Developed by Dr. Nathan Canney's [10], validated and tested in his work
- A framework that models how social responsibility may be developed in professionals.
- "Professional" SR can be developed independently from "Personal" SR
- EPRA is the corresponding assessment to that measures SR development for each construct/dimension shown here.

What is EPRA Assessment?

- EPRA = “Engineering Professional Responsibilities Assessment”
- Developed by Dr. Nathan Canney’s [10], validated and tested in his work
- A survey/assessment that quantitatively measures SR development in relation to the PSRDM tool