Improving Teamwork Skills in Geological Engineering

Some Early Results

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Why study teamwork skills?

- One of 12 “graduate attributes” required by Canadian Engineering Accreditation Board (CEAB)
- Valued by employers (e.g., commonly listed as necessary skill in employment postings)
- Necessary for success in capstone design project course
  - Intensive teamwork experience
Capstone Design Project Course

- New in 2011/12, replaced individual theses
- Common to many engineering undergraduate programs in senior year
- Students work in groups of 4±1 on open-ended design projects from Sponsors
- Core course (6 credits)
- Teams are selected for diversity by instructor
- Teams work together September to April
Interventions

- Personality (Type Focus) Workshop
- Teamwork Workshop
- Group Dynamics
- Effective Feedback
- Conflict Resolution
- Negotiation
- Behaviourally Anchored Peer Evaluation
  (Comprehensive Assessment of Team Member Effectiveness)
Research Tools

Subject is entire 4th year GEOE cohort
Control group is 4th year mining eng. cohort

1. Pre-/Post-course survey (subject & control)
2. Mid-course survey
3. Two focus groups
4. Writing assignment about teamwork
5. Two peer evaluations, including comments

Items 2 through 4 apply to subject group only
Pre-/Post-Course Survey

- Anonymous, but with provision for ‘matching’
- 24 engineering and teamwork-related skills
  3 questions on each:
  - How IMPORTANT is this skill in engineering?
  - How CHALLENGING is this skill to acquire?
  - How CONFIDENT are you in your current skills in this area?
- Each rated on similar Likert scale, where:
  1=Not, 2=Slightly, 3=Moderately, 4=Very and 5=Extremely
  Important, Challenging or Confident, respectively
Pre-/Post-Course Survey Questions

• Drawn from:
  ◦ CEAB descriptions of “graduate attributes”
  ◦ Capstone course learning objectives
  ◦ Other instruments to measure teamwork skills*

• Some repeated using modified wording

• Order meant to be “random”

  e.g., Team Skills Survey, Grymonpre et al. 2010
Example Questions

To be able to…

• Appreciate the value of diversity on a team
• Promote a team culture of honesty, openness and trust
• Produce clear technical documents
• Manage conflict productively in a way that preserves relationships
• Educate yourself to maintain professional competence
Some Early Results

- Pre-course survey comparison of groups
  - Subject and control groups very similar

- Pre-post comparison of subject group
  Noticeable differences before/after course…
  - Little change in opinion on IMPORTANCE (+/-0.1)
  - Increased rating on degree of CHALLENGE (+0.2)
  - Greater increase in rating of CONFIDENCE (+0.3)
What is important?

- 3 increased, 10 decreased, 11 little change (<+0.1 overall)
- **Largest increase (0.4)**
  - Help draw out team members who are not participating actively in team meetings
- **Second largest (0.2)**
  - Function effectively as a member of a small team
- **Less important than originally thought (-0.2)**
  - Presenting technical information orally
How important is this skill in professional engineering?

Survey question

Pre-Course
Post-Course
What is challenging?

- 15 increased, 4 decreased, 5 little change (+0.2 overall)
- Largest increase (0.7…0.4)
  - Function effectively as a member of a small team
  - Contribute to team cohesion and development
  - Apply professional ethics in your work
  - Contribute a fair proportion of effort on team deliverables
- Less challenging than originally thought (-0.3)
  - Present technical information orally
How confident are you?

- 21 increased, 3 little change (+0.3 overall)
- Largest increase (0.7)
  - Educate yourself to maintain professional competence
- Second largest increase (0.5)
  - Read, understand and interpret information
  - Deliver effective presentations to technical audiences
  - Help draw out team members who are not participating actively in meetings
- Less confident than the beginning of year…
  - Absolutely nothing!!
How confident are you in your current skills in this area?

Survey question

- Pre-Course
- Post-Course
Student Reflections on Teamwork

- “Teamwork is more than just having compatible personalities, and being able to divide up work evenly for the project.”
- “I did not expect to feel so supported by my team members as I did.”
- “Another point that has helped our success as a team has been social interaction outside of team meetings.”
Student Reflections on Teamwork

- “One of the most important things I will take away from this teamwork is how we have accomplished more by caring about one another…”
- “Valuing the work of others and taking an interest in their personal lives will foster a great sense of comradery that will help your group be successful.”
Analysis Still To Come

- Comparison of pre-/post-course survey results for individuals (matched “anonymously”)
- Comparison of pre-/post- results for control group itself, both as a class and individually
- Comparison of subject and control group results from post-course survey
- Adjustment of in-class interventions
- Repeat of pre-/post-course surveys (2016/17)
- Analysis of impact of interventions
- Improvement of “anonymous” matching system
Selected References

- Canadian Engineering Accreditation Board, 2014, Accreditation Criteria and Procedures, Engineers Canada

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