Measuring Changes in Student Perceptions After Using a MATLAB Tool in First-Year Chemical Engineering

Mary Robinson*, Luis Ricardez-Sandoval, Raymond Legge

April 26, 2012

OND 2012 - Session 307

*Mary Robinson, Lecturer, First-Year Engineering Office, University of Waterloo
519.888.4567 x32529, mary.robinson@uwaterloo

What is Effectiveness?

Effectiveness *(n):* producing or capable of producing a desired effect (www.thefreedictionary.com)

But defining effective teaching is difficult (HEQCO, 2008)

- Setting list of desirable characteristics
- Developing measurement tools
- Closely related to student learning measures

Students in Our Study

- UW Engineering is divided into 8 academic terms and 6 co-op work terms
- Students in this study are in 1B:
  - second academic term at UW
  - some have had one co-op work term
- 1B ChE students are a cohort in 5 courses
  - Common complaint that students don't know why they are taking some courses
  - One course is commonly cited (ChE121 - MATLAB)

Focus Group Feedback

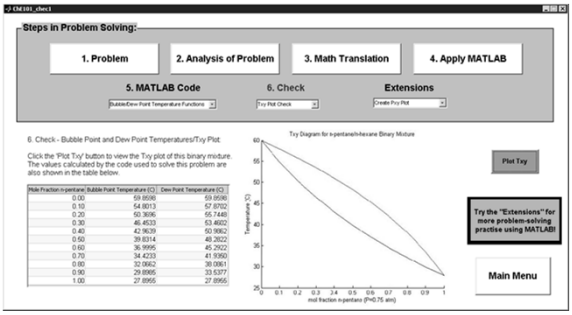
Focus groups of senior ChE students told us:

- Several fourth year students observed that many concepts taught in the first-year courses "*came back to haunt [them]" in upper years*
- *"looking back [she] can see how [she] could have used MATLAB in all of [her first-year] courses"*
- MATLAB's *"built-in functions are so useful, and if people only knew about them it would make their lives so much easier"*

Our Study

Develop MATLAB Tool

- Applications of programming in MATLAB as ChE
- Highlight connections between courses using examples
- Follow a structured problem-solving methodology



Effectiveness of Our Tool

If effective, we would expect to see:

- Increased willingness to use MATLAB
- Willingness to solve more computationally difficult problems
- Recognition of connections between 1B courses
- Adoption of problem-solving methodology

Pre- and Post-Questionnaires

- Set of 20 questions
  - Derived from focus group input
  - 7-point Likert scale to indicate level of agreement
- Pre-survey in first 2 weeks of term, post-survey in last week of term
- Questions include:
  - I think that the material taught in my 1B ChE courses is not related to each other.
  - I regularly use a problem solving technique to figure out tricky problems.
  - I don't know why I am being taught to use MATLAB.

History

- January-April 2011: "Control" group
  - No significant change in student attitudes
- May-August 2011: "Test" group
  - No significant change in student attitudes
- Problem with survey questions?
- Other confounding factors?
  - Co-op experience of test group
  - 4 of 5 people on the teaching team changed

History

- Study group
  - Targeted discussion with students from test group
- Interesting observations
  - Time constraints during 12-week term
  - Already know MS Excel from high school and don't want to learn a new program if not necessary
  - "*[the MATLAB Tool] is a good demonstration for individuals who haven't had prior experience to MATLAB*"

History

- Repeat "Test" Group January-April 2012:
  - Modifications to questionnaire to include some open-ended questions
  - 3 of 5 instructors consistent with the "control" group

Next Steps?

- Methodologically, are we asking the right questions to measure any change?
- Are we expecting too much of our first-year students (most are 18 years old with no co-op experience)?
- Is the application of the MATLAB Tool appropriate?
- Is the MATLAB Tool not the right way to help students achieve these goals?
- Or something else?

Acknowledgements

Thank You!

- Financial support from UW Learning Initiatives Fund (LIF) grant.
- Guidance from UW's CTE Nicola Simmons, Shirley Hall, and Julie Timmermans
- Valuable feedback obtained from the focus and study group participants

References

George, J., Cowan, J. 1999. A Handbook of Techniques for Formative Evaluation. Kogan Page, London UK.

Gravestock, P. and Gregor-Greenleaf, E. 2008. HEQCO Student Course Evaluations: Research, Models and Trends.

www.thefreedictionary.com