Challenges of Flipping a Course in Geomatics Engineering

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BACKGROUND AND OBJECTIVES

- Many engineering undergraduate and graduate courses are offered now as flipped courses.
- Is the “flipped classroom” model really a new thing in teaching and learning?
- Observed resistance among the engineering students against active learning methods
  - What can be done to decrease the resistance and increase student motivation?
- If flipping an entire course is a risky undertaking, can we flip only one course component?
KEY ASPECTS OF THE FLIPPED CLASSROOM MODEL (1/3)

“.... a pedagogical model, in which the lecture and homework elements of a course are reversed” (Faculty Focus, 2015):

- **inverted learning environment = blended learning** (Jamieson *et al.*, 2015)

- **individual learning activities**: video-recorded lectures assigned as homework, assigned readings, reviewing key concepts, gathering background information, and completing self-assessments, among others

- **face-to-face class time**: high-level and collaborative activities such as applying concepts, problem-solving, discussions, interpretations, analyses, design and project work, among others
KEY ASPECTS OF THE FLIPPED CLASSROOM MODEL (2/3)
Learning methods classified by the use of a computer-mediated environment
A second definition of the flipped classroom model focuses on the strong link with the student-centered (active) learning methods:

- **main advantage**: focus is on learners
- **active face-to-face interactions**: enriched student classroom experience in collaborative, synchronous and hands-on group activities
- **shared expertise**: method suitable for engineering project-based and design courses
- **student motivation**: a key factor for the success of the “flipped classroom” model
LEARNING ACTIVITIES IN A FLIPPED CLASSROOM (1/2)

Learning activities in a flipped classroom - within the framework provided by the engineering graduate attributes (Engineers Canada, 2016) and course learning outcomes.

Three learning phases according to Bloom’s revised taxonomy:

- **Level 1**: Remember - Understand
- **Level 2**: Apply - Analyse
- **Level 3**: Evaluate - Create
LEARNING ACTIVITIES IN A FLIPPED CLASSROOM (2/2)
Activities in the flipped classroom model (modelled after University of Adelaide, 2017)

Graduate Attributes
Course Learning Outcomes
Activities in Flipped Classroom

BEFORE CLASS
- Review prerequisite knowledge
- Introduce and explain new concepts
- Understand concepts
- Identify keywords
- Collect feedback

IN CLASS
- Discuss real-world applications
- Analyze case studies
- Group work
- Debates, Tutorials
- Discuss feedback
- Address problem areas in learning

AFTER CLASS
- Examinations
- Reflections
- Summaries
- Assignments
- Research paper
- Technical report
- Peer evaluation

Student Accountability and Graduate Attribute Assessment
Geomatics engineering courses can span the entire range with respect to the content load and hands-on learning.

**Content heavy** | **Hands-on heavy**
---|---
Least-squares estimation | Field surveys (survey camps)
Land tenure and cadastral systems | High-precision surveys
Geomatics networks | Geomatics engineering (capstone) project
Photogrammetry | Land use planning
Coordinate systems | Survey law
Geodesy | Geodetic and engineering surveys
GEODESY

- **before-class** activities
  - watch selected videos on gravity topics
  - identify keywords to search for information on gravity-related engineering applications
  - write a short essay (*accountability*)

- **in-class** activities
  - discuss and analyse selected examples
  - illustrate key concepts in lectures

- **after-class** activities
  - group work on a research question (*accountability*)
GEOMATICS ENGINEERING EXAMPLES (3/3)

GEODE蒂C AND ENGINEERING SURVEYS

• before-class activities
  o review prerequisite survey concepts
  o find standards and relevant information
  o understand new concepts and procedures

• in-class activities (lectures and tutorials)
  o analyse new concepts in class
  o test new procedures in tutorials (*accountability*)
  o analyse and compare outcomes

• after-class activities
  o design and plan a survey project, project specifications and quality control procedures
  o modify survey procedures to meet designed specifications
  o evaluate individual and teamwork (*accountability*)
CONCLUSIONS

• The “flipped classroom” combines the main advantages of online and face-to-face teaching and learning:
  o “before-class” time-flexible, independent and individual learning
  o “in-class” collaborative and deep learning

• Requires careful planning of learning activities and student assessment and accountability (can mitigate student resistance)

• One course component can be flipped at a time to enhance student learning and enrich the classroom experience.