High to Low Tide: The high school–university transition

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Abstract

This presentation is based on a three-year research study examining the transition from high school to university as experienced by students enrolled in 1st-year chemistry, who are predominantly life science students. This is a relatively smooth transition for some, but extremely traumatic for others who find that high school excellence does *not* translate into university success. Data from student and teacher surveys, as well as group interviews, will be presented illustrating the breadth of the problem confronting many first year life and physical science students – and their instructors! This interactive session will not only explore the issues raised by the data, but also encourage discussion of the participants' own observations and experiences. The session will include a brainstorming session to develop strategies for university instructors and student academic skills centres to assist students who are struggling with this important transition. Ways in which instructors can connect with high school teachers will also be explored. More information can be found on the project web site at http://www.chem.utoronto.ca/~dstone/Research/ROP299.html

Getting to Know You:

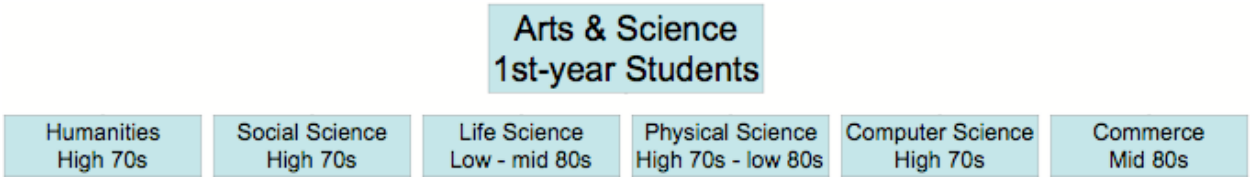
Are there any common themes?

Chemical Education Survey:

- 2nd-year Research Opportunity Program
- 18 student researchers over three-year period
- Research questions:

Institutional Background and Survey Cohort Demographics:

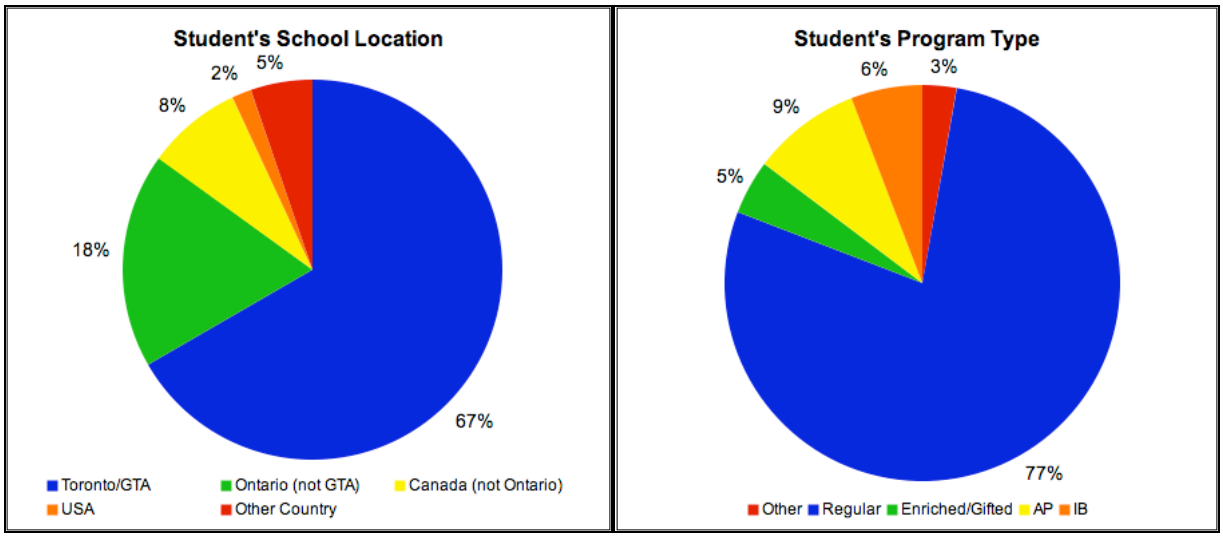
The University of Toronto St. George (Downtown) campus accepts students into one of six general subject areas; students apply for specific programs of study at the end of 1st-year.

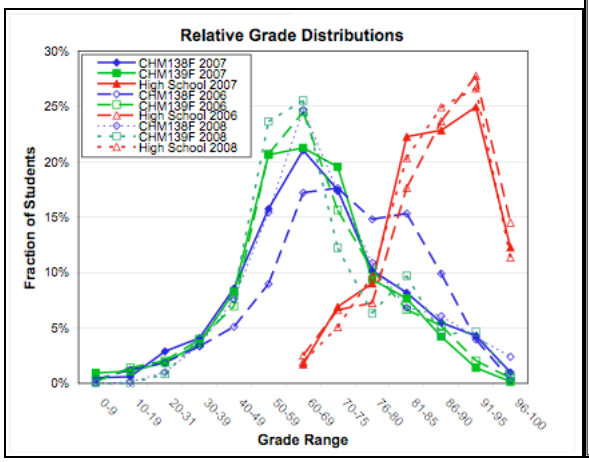


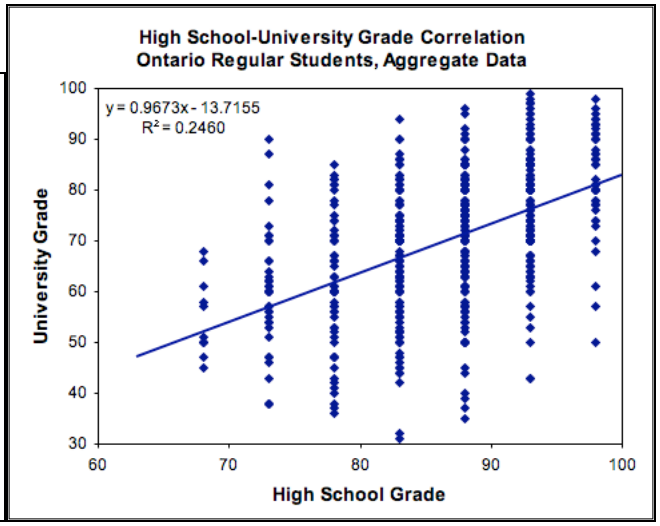
Averages for admissions purposes (2006-7):

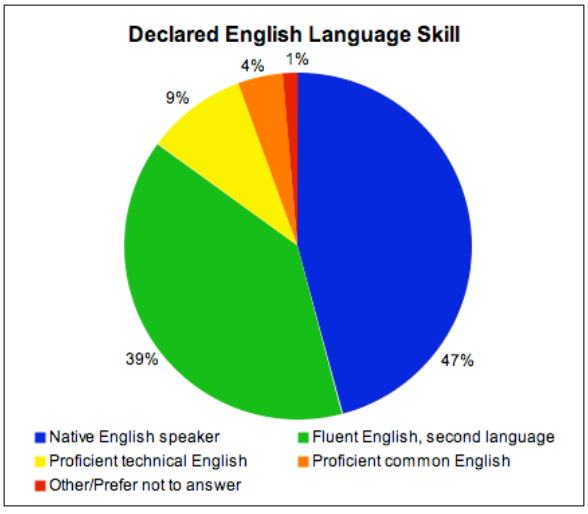
Arts	84.2%
Science	88.5%
Commerce	87.2%
Overall	86.2%

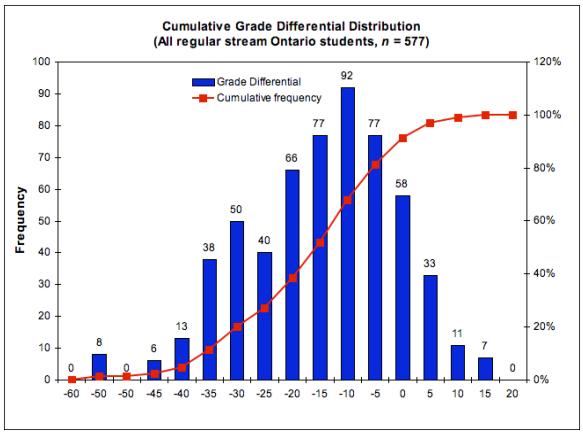
Category	2006/7	2007/8	2008/9	Aggregate
Size of survey cohort:	1830	1803	1723	5356
Total number of responses:	320 (17.5%)	536 (29.3%)	414 (24.0%)	1270 (23.7%)
Gender:[1,2]				
Male	–	211 (39.4%)	168 (40.6%)	40.0%
Female	–	324 (60.6%)	246 (59.4%)	60.0%
ESL students:	–	55.2%	53.9%	54.9%
Semestered programs:	–	58.4%	65.1%	61.3%
Had ISU:	56.0%	57.7%	44.9%	53.2%
Average HS grade ± s (%):	87.3 ± 10.6	87.1 ± 7.1	87.3 ± 7.2	87.3 ± 7.4


Student's School Location
5%
2%
8%
18%
67%
Toronto/GTA
Ontario (not GTA)
Canada (not Ontario)
USA
Other Country
Student's Program Type
6%
3%
9%
5%
77%
Other
Regular
Enriched/Gifted
AP
IB


Relative Grade Distributions
Fraction of Students
Grade Range
CHM138F 2007
CHM139F 2007
High School 2007
CHM138F 2006
CHM139F 2006
High School 2006
CHM138F 2008
CHM139F 2008
High School 2008


High School-University Grade Correlation
Ontario Regular Students, Aggregate Data
y = 0.9673x - 13.7155
R² = 0.2460
University Grade
High School Grade


Declared English Language Skill
4%
1%
9%
39%
47%
Native English speaker
Fluent English, second language
Proficient technical English
Proficient common English
Other/Prefer not to answer



Predicting Success:

See for example refs. 3–13; similar studies exist for math & physics.

Tai & Sadler (refs. 16–18)

Content-based Diagnostics:

Toledo Placement Exam (refs. 11, 12, 14 and web resource 1)

California Chemistry Diagnostic Test (ref. 15 and web resource 2)

CIC Canadian Chemistry Contest (formerly the National High School Chemistry Exam; web resource 3. See also the Canadian Chemistry Olympiad, resource 4)

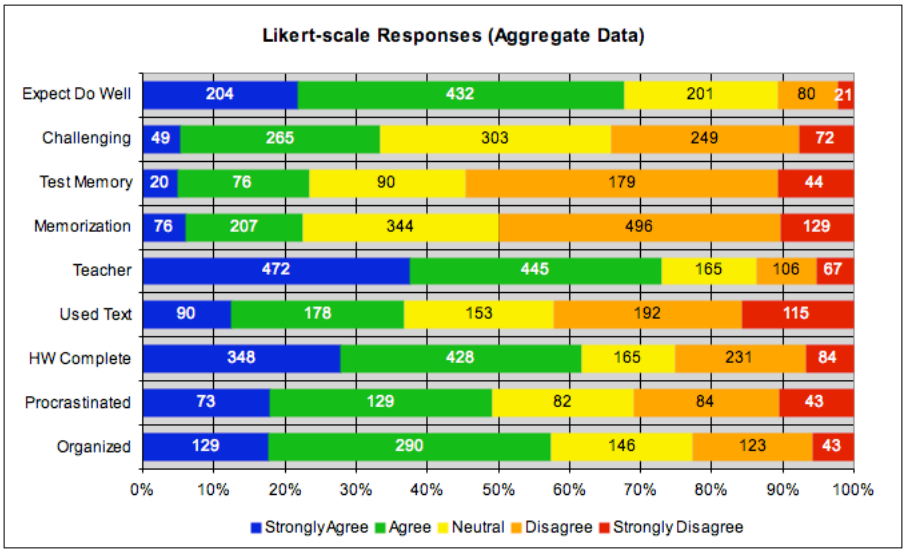
Does your department or faculty use content-based tests before, or early in, your 1st-year courses?

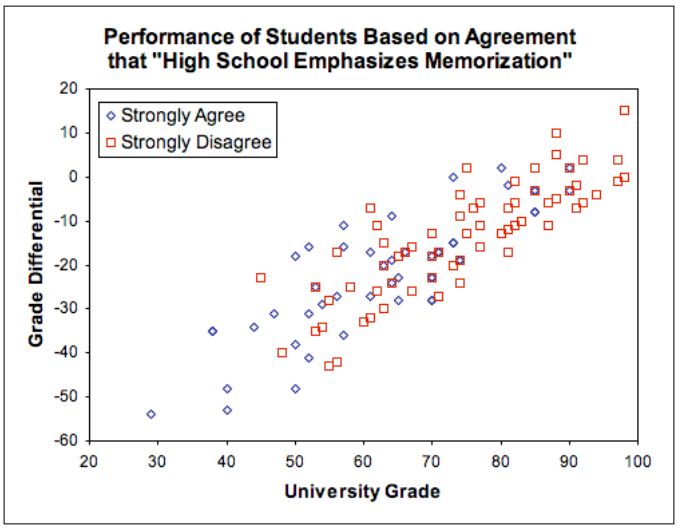
- If yes, what, & with what results/consequences?
- If no, could you, and would that be useful?

*** See final pages for discussion notes from this section ***

Student Perceptions of School:

1. I expect to do well in university chemistry
2. I found HS chemistry challenging
3. HS tests emphasized memorization
4. HS classes emphasized memorization
5. My teacher performed effectively
6. I always completed my homework
7. I procrastinated a lot
8. I was organized and used my time effectively



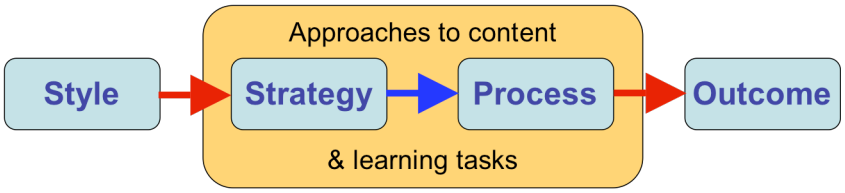


Psychology of Learning:

VARK (resource 5):

What many associate with "learning style":
Visual, Auditory, [Read-write], Kinesthetic [, Tactile]
Not really what I want to focus on here though…

Student Approach to learning and learning tasks:



Categories describing distinctive approaches to learning (From Ref. 19)

<table>
<tr><th rowspan="2">Orientation & intention</th><th rowspan="2">Motivation (personality)</th><th rowspan="2">Style</th><th colspan="2">Process</th><th rowspan="2">Outcome</th></tr>
<tr><th>Stage I</th><th>Stage II</th></tr>
<tr><td rowspan="2">Understanding</td><td rowspan="2">Intrinsic

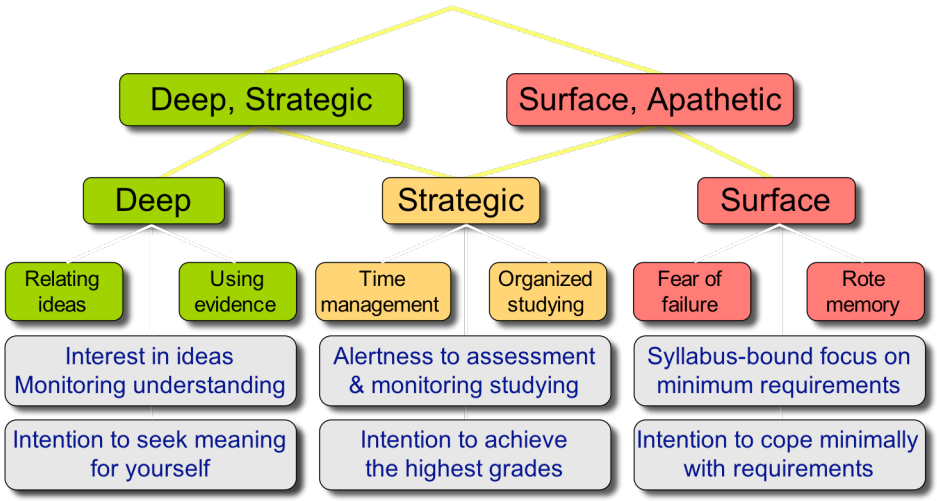
(Autonomous, syllabus-free)</td><td>Deep approach (versatile)</td><td colspan="2">All four processes below used appropriately to reach understanding</td><td>Deep level of understanding</td></tr>
<tr><td>Comprehension learning</td><td>Building overall description of content area</td><td>Reorganizing incoming information to relate to previous knowledge or experience and establishing personal meaning</td><td>Incomplete understanding attributable to globetrotting</td></tr>
<tr><td rowspan="2">Reproducing</td><td rowspan="2">Extrinsic, fear of failure

(Anxious, syllabus-bound)</td><td>Operation learning</td><td>Detailed attention to evidence and steps in the argument</td><td>Relating evidence to conclusion and maintaining a critical, objective stance</td><td>Incomplete understanding attributable to improvidence</td></tr>
<tr><td>Surface approach</td><td>Memorization</td><td>Over-learning</td><td>Surface level of understanding</td></tr>
<tr><td>Achieving high grades</td><td>Hope for success

(Stable, self-confident)</td><td>Organized/ Achievement orientated</td><td colspan="2">Any combination of six above processes considered appropriate to perceived requirements of task and criteria of assessment</td><td>High grades with or without understanding</td></tr>
</table>

Note that this forms the basis of the “Approaches and Study Skills Inventory for Students” (ASSIST) instrument. See refs. 19–22 and web resource 7 for more details.

ASSIST Concept Map:



- Does your department or faculty offer student skill courses *as part of the core 1st-year curriculum*?

- Does your department or faculty use learning style tests before, or early in, your 1st-year courses?

  – If yes, what, & with what results/consequences?
  – If no, could you, and would that be useful?

Potential Pitfalls:

Teaching approach (ref. 23-25, resource 6)

- Transmission learning vs. student-focussed
- Content-driven delivery (external forces)
- Dependence on TAs ⇒ effective training
- Pratt's Five Teaching Perspectives (TPI)

"... we have found no research reporting on the outcomes for teachers from their approaches to teaching."

Trigwell et al, Higher Ed. 1999, 37, 57-70

Assessment (ref. 25–27)

- 'Transformational' (deep) vs. 'reproducing' (surface) for essay vs. multiple-choice

  Thomas & Bain, Human Learn. 1984, 3, 227-240
- Instructor intention vs. actual questions
- Problems vs. exercises
- Nature of assigned vs. assessment questions
  - Use categorization scheme e.g. Bloom's taxonomy

Workload (ref. 26–27)

- Perceived workload

"Students could work long hours and still obtain poor grades because they used inappropriate learning approaches"

Kember et al, Studies Higher Ed. 1996, 21, 347

- Average cap of 50 hours/week for all tasks
- Increasing class time decreases studying
- Surface approach related to lower English proficiency:

"A surface strategy of memorising key words or phrases is consistent [with those] who operate at the word or sentence level"

Skills Intervention (ref. 21, 28)

Misplaced intervention

"The overall consequence of allowing the interventions to develop their own character ... was that most of them focussed on skills which were considered important by the students for successful learning in each course."

Ramsden et al, Human learn. 1986, 5, 151-164

Difficulty of implementation

"Study skills advice and training has been criticised as being ineffective, largely because it is so often offered as an adjunct to a course and students have difficulty in transferring the advice they read into their own context"

Tait & Entwistle, Higher Ed. 1996, 31, 97-116

The ROP Student Teams:

2006-7:

Robin Baj
Michael Lebenbaum
Sujan Saundarakumaran
Derrick Tam
Jakub Vodsedalek

2007-8:

Mena Gewarges
Cindy Hu
Gordon Ng
Jana Pfefferle
Curtis Wang

2008-9:

Marlena Colasanto
Lauren Cosolo
Darrin Gao
Inna Genkin
Kelly Hoang
Justina Lee
Bryan Nguyen
Emily Plobner

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-
- U of T 1st-year students, for participating
- 1st-year instructors and peer mentors
- Faculty of Arts & Science (financial support)
- RCAT/portal staff (technical assistance)

Student Voices:

The following quotations are taken from the student surveys and focus groups run between Fall 2006 and Spring 2009, to serve as background illustration for the various ways in which students respond to the high school–university transition. Some reflect positive, while others reflect negative, experiences.

University:

"tests ... were for failing the students and discouraging students to go on with their hopes and dreams"

"I feel my high school teachers prepared my very well for university, even though it was a big jump. Sometimes, change and challenge are nice and necessary for progress. Without challenge, we would all stay stagnant and there would be no scientific, political, social, or personal progress."

"I found that the university chemistry experience was too hectic. Although I spent quite a bit of time studying the material, the ... exams were almost impossible for me to complete"

"The university instructors are somewhat surprisingly good - they teach well, are interesting etc. compared to high school teachers in general."

Grades:

"Even though most of us expected that [university] is going to be challenging, I think that a lot of people believed that because they did well in high school, it automatically translate into doing well in university..."

"In high school, although I was able to achieve an adequate grade, I didn't really knew how to understand chemistry. Now in university, it is pretty much the opposite. I don't get the mark I used to get in high school but I actually understand how and why things happen"

"I am doing very poorly ..., and this is really depressing me after gettign a 94% in grade12 chemistry. I find some of the concepts hard to grasp."

"Overall, I was very lucky. My teacher taught us how to learn chemistry and always discouraged memorizing concepts. As a matter of fact, I've been told that most people achieve higher marks in [university] than in his class"

Teaching:

"We kinda had to teach ourselves … [the teacher] would put [overheads] on the board and as we were trying to copy them down, [they] would explain so no one would actually listen to her."

"My teacher … taught very much like a professor … he gave us notes ahead of time [and] would assign readings ahead of time. … It's just that I find university a lot more fast paced…"

"I find that I'm doing better than I [did] in high school, but the only reasons why is because I was scared… I'm actually glad that the teachers took the time to tell us about their past experience in university…"

"My Physics teacher … taught a lot about what to expect … strategies and attitudes we'd have to have."

Evaluation:

"My biology teacher … took a university exam and structured his questions on those questions"
"I think the multiple choice was something that I was really worried about."
"In high school, the [tests] were more memorizational and less conceptually based (i.e. one could get an A without knowing chemistry"
"They [university] test your ability to take tests"
"Questions on high school tests involving higher thinking are rare."
"In AP they gave us more application questions and its basically what they are giving us now."

Pace:

"[The pace at university] is quite a lot faster, and it requires a lot of motivation on your part and independent learning"
"There's always pressure being put on you"
"I found that my time management skills were the only thing that was keeping me alive."
"There's four other mid-terms [in other courses] between the first and second midterm and like I didn't even go to any chemistry lectures and by the second mid-term two days before that…"
"I think it would have been better if, like, at the end of high school , they cranked it up a bit"

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Web Resources:

1. The Toledo Examination, http://www4.uwm.edu//chemexams/materials/details_exam.cfm?ID=150
2. The California Chemistry Diagnostic Test, http://www4.uwm.edu//chemexams/materials/details_exam.cfm?ID=148
3. The CIC/CSC Canadian Chemistry Contest, http://www.cheminst.ca/index.cfm?ci_id=2762&la_id=1
4. The Canadian Chemistry Olympiad, http://www.chem.utoronto.ca/IChO.Ontario/
5. The VARK guide to learning styles, http://www.vark-learn.com/english/index.asp
6. The Teaching Perspectives Inventory (TPI), http://teachingperspectives.com/
7. The Approaches and Study Skills Inventory for Students (ASSIST) questionnaire. http://www.etl.tla.ed.ac.uk/questionnaires/ASSIST.pdf
8. The Kolb learning styles inventory, http://www.learningfromexperience.com/
9. Advanced Placement (Canada), http://www.ap.ca/
10. International Baccalaureate, http://www.ibo.org/
11. Ontario Ministry of Education Curriculum (Science, 9–12), http://www.edu.gov.on.ca/eng/curriculum/secondary/science.html
12. Ontario Ministry of Education Assessment, http://www.edu.gov.on.ca/eng/document/forms/report/sec/srepgde.html
13. The Chem Ed Project, http://www.chem.utoronto.ca/~dstone/Research/ROP299.html
14. The York/Seneca Institute for Mathematics, Science, and Technology Education (YSIMSTE), http://www.ysimste.ca/
15. Science Teachers Association of Ontario, https://stao.ca/

Discussion Notes:

These notes are abstracted from those recorded by the individual discussion groups during the actual conference presentation, and relate to the questions regarding the use of pre-course evaluation methods for streaming or skills/content-based interventions. These are offered as recorded; since I was not party to each discussion, I obviously cannot provide any additional context or elaboration!

Group 1:

- Could stream to two different courses based on general high/low high school course grade.
- "Math Reprieve" – students who fail first, start over in a slower (stream?)
- Early quiz – students take test and grade themselves. Quiz questions are identified after the test as recall, application, comprehension, or analysis.

Group 2:

- Do P test (?) for marks before class starts
- Offer re-write on first essay, look for improvements
- Students who don't take recommended courses (based on skills test by student support centre?) often fail!
- Entrance diagnostic for literacy & numeracy skills; compare results to HS grades

Group 3:

- NSAC Chemistry used to do entrance diagnostic test but not for last 8-9 years as insufficient correlation to failure; note concerning stress of first week; still used in Math to determine if student can enter calculus course
- UNB Comp Sci. uses math placement test; depending on grades, students in either regular calculus course, a "stretched" calculus course, or a pre-calculus course
- UWO Soc. Sci. – major issue is literacy, very poor skills in general; offer a course in showing up poor writing skills; lack of focus on grammar in HS becomes an issue in University and the workplace.