

# Bridging the Gap: The High School–University Transition in Chemistry

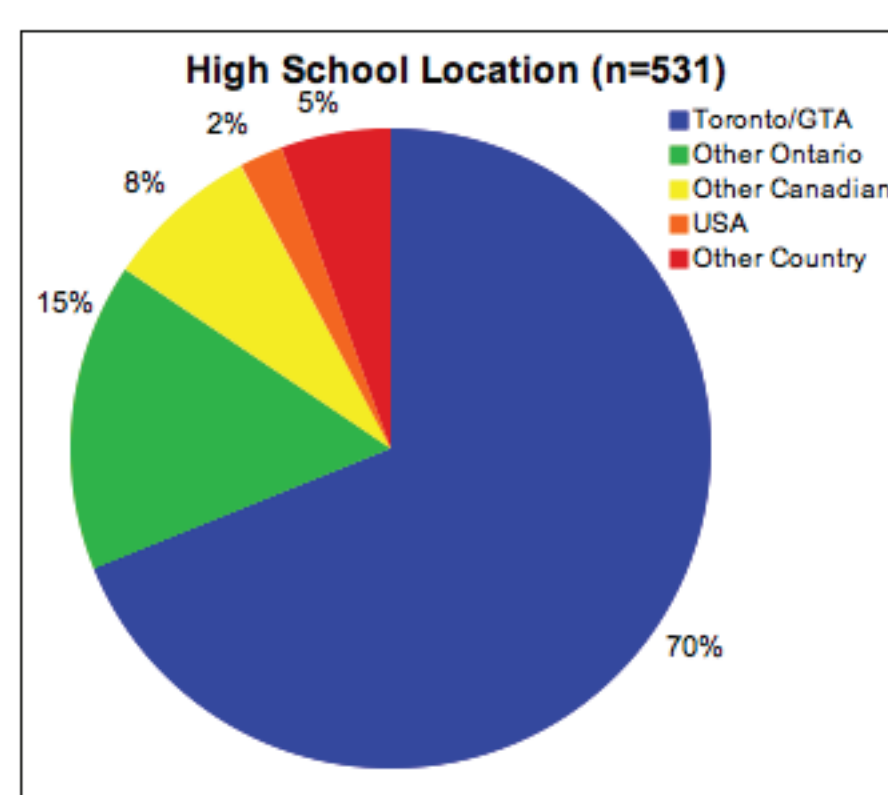
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## Student Profile:

- 1803 students in 1<sup>st</sup>-year chemistry
- 536 completed surveys (29.3% response rate)



Gender:<sup>1</sup>  
60.6% female  
39.4% male

Native english speaker:  
44.8%

HS course timetable:  
58.3 semester-based  
41.7 year-long courses

HS Chemistry Grade:  
Reported average 87%  
(A&S admissions ave. 88.5%)<sup>2</sup>

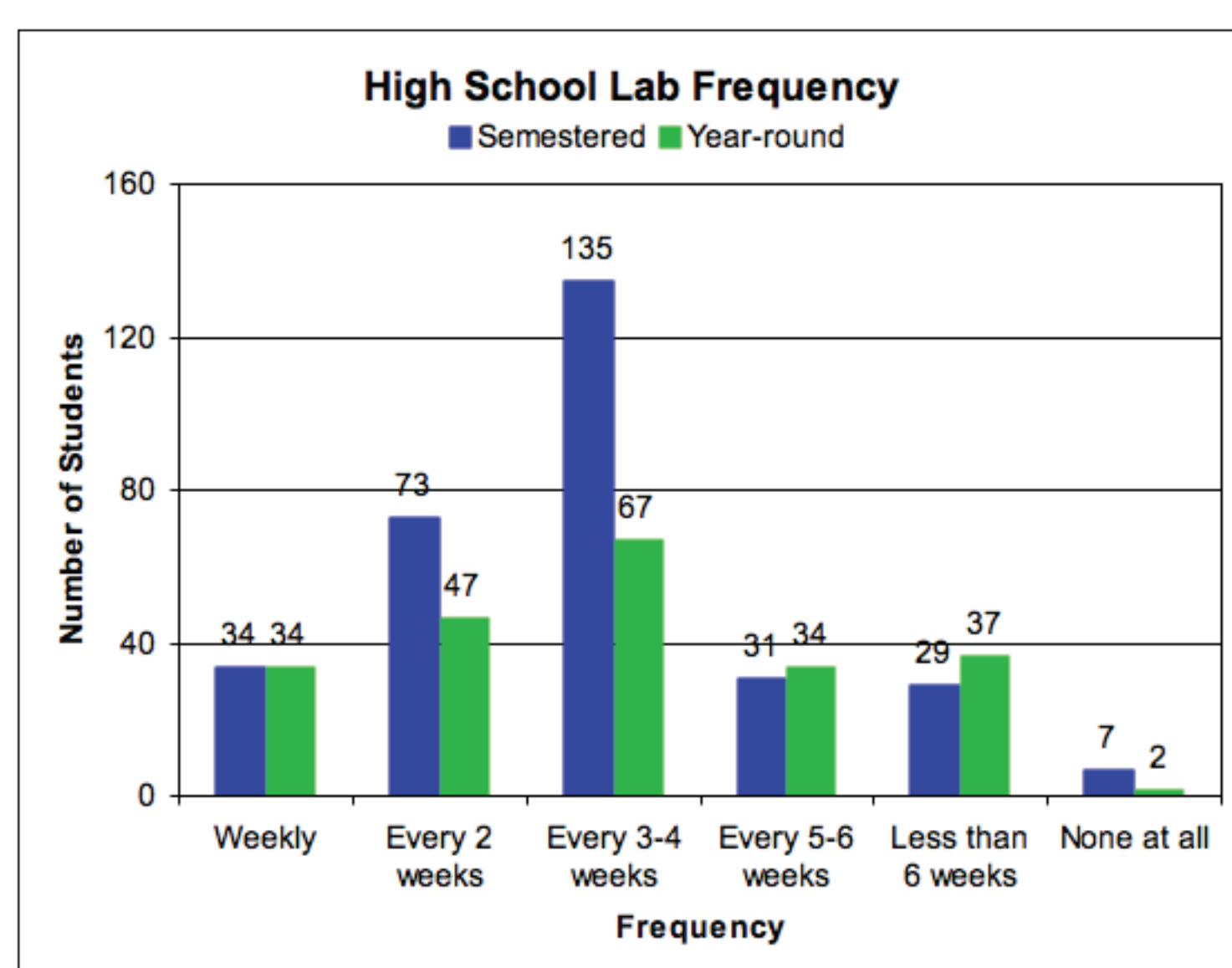
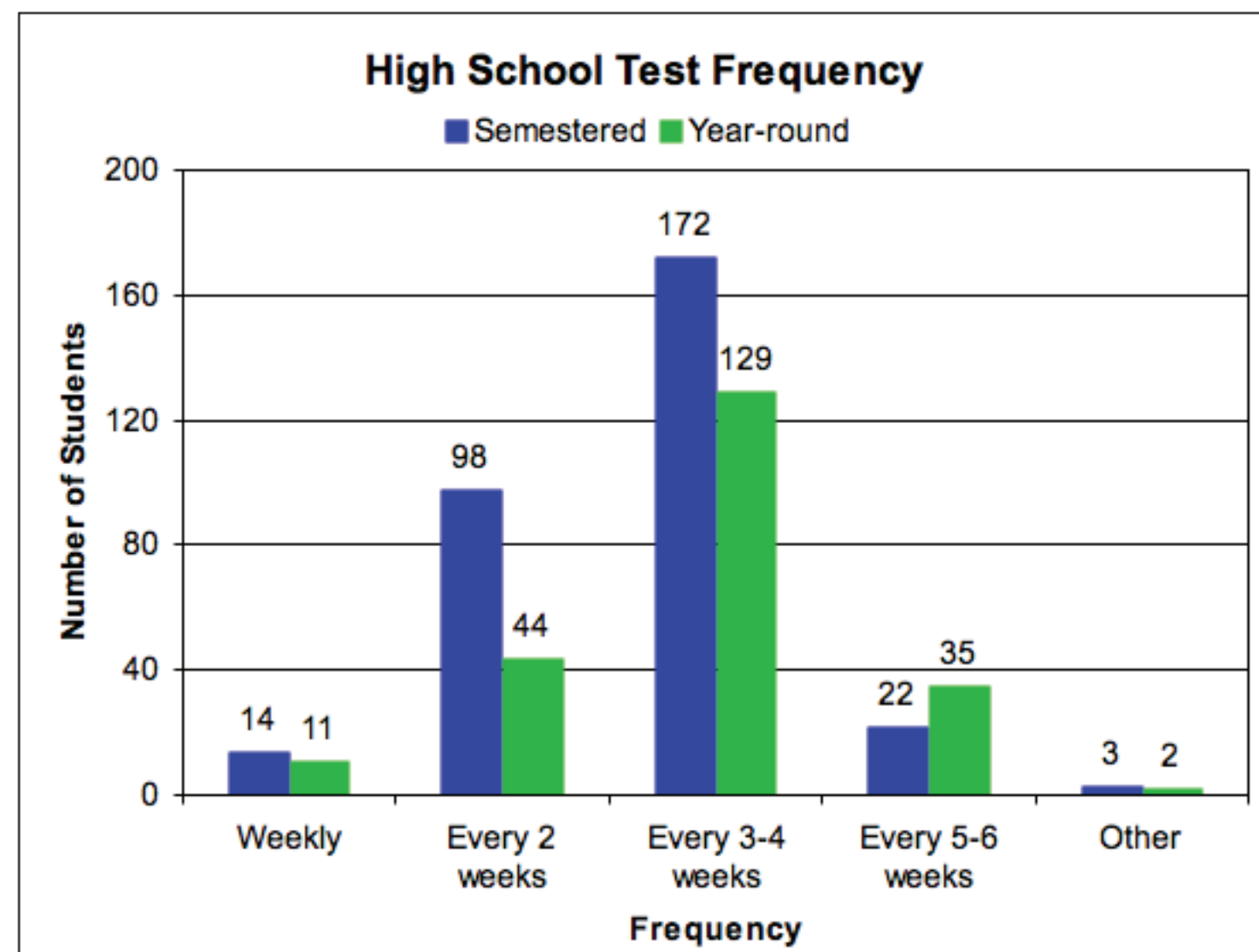
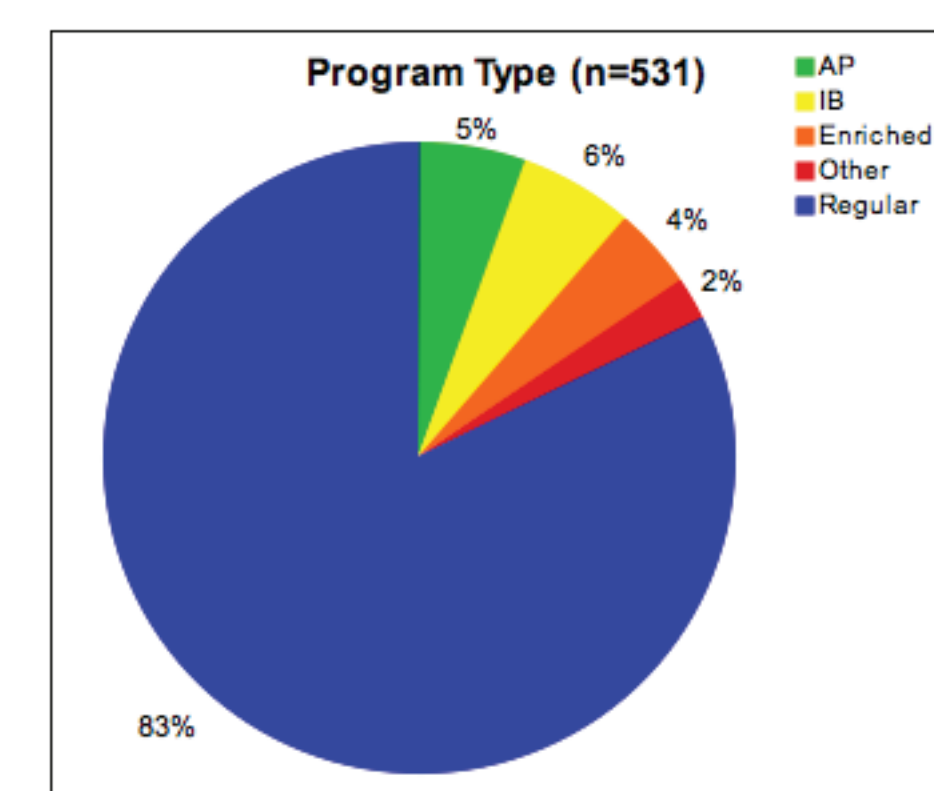
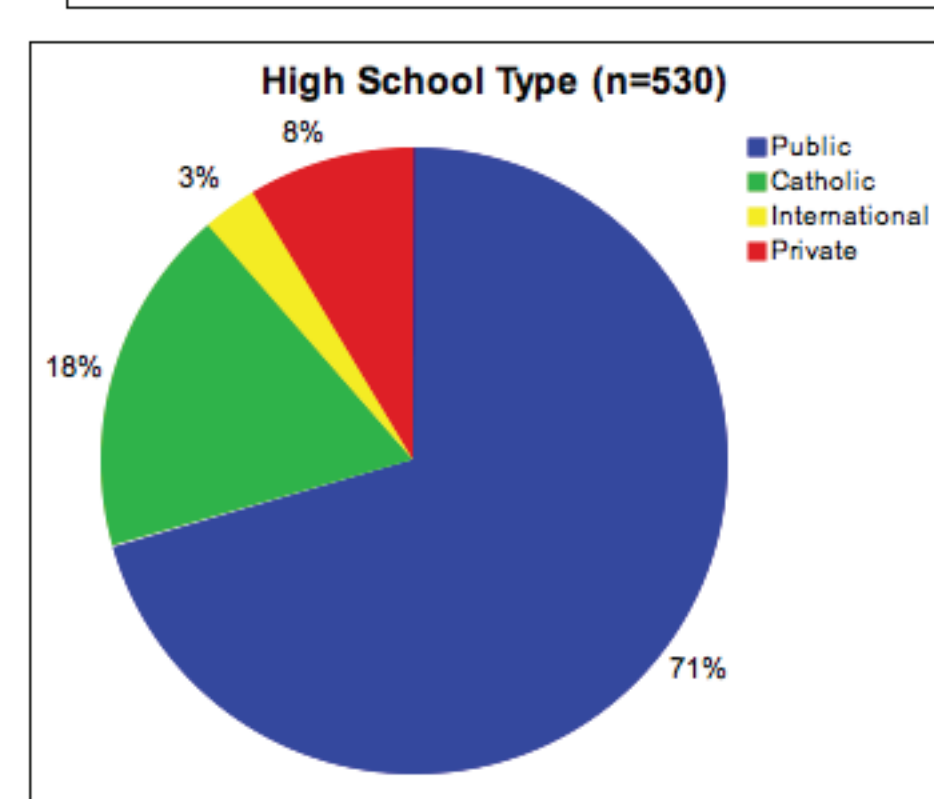
Schools represented:  
278 distinct schools  
200 Ontario schools

Program types:  
AP – Advanced Placement  
IB – International Baccalaureate  
Other – A-level, GCSE, etc.

Had Independent Study:  
306 students (57.7%)

*"AP... is both more in-depth and more work load"*

*"I didn't think [AP chemistry] was that advanced. I took AP physics too and ... it's virtually no help whatsoever"*



## The Project:

Each year, about 1,800 students enrol in our first year chemistry programs. While some manage the transition from high school to university well and thrive, many others struggle. This continuing chemical education research project seeks to understand the factors affecting this important transition, and to make recommendations to students, high school teachers, and university instructors on best practices that will help students experience a smoother transition. This project is similar to a recent US study.<sup>2,3</sup>

1. What factors contribute to a successful high school-university transition?
2. What can schools and universities do to help students manage this transition?

## Common Themes:

- Pace of university classes
- Lack of advanced conceptual or problem-solving questions in texts
- Inefficient or ineffective study habits
- Discrepancies between TAs in labs & tutorials; lack of timely feedback
- Transitions between instructors in multiple-instructor courses
  - style & level of exam questions
  - differences in use of handouts
- Miscommunication/misunderstanding

*"I try to catch up and when I'm almost done catching up, there's another midterm.... I keep falling behind"*

*"I'm still adjusting to the freedom you have here."* *"Mastering Chemistry does not help, I feel like we don't enough feedback [on labs]"* *it was so far away from the actual test"*

*"...during high school, my study time was used for revision or concepts. At university, my study time is actually learning time."*

*"My TA, [is] kinda boring 'cause he teaches me what I already know"* *"Last year my TA didn't even know English"*

*"My TA goes over things and I understand when I go... I get the material much more than [the lecture]"*

*"I have a professor who doesn't have a PhD, he's just a lecturer" [!]* *"The questions that they ask you ... go way beyond to what you did in the textbook"*

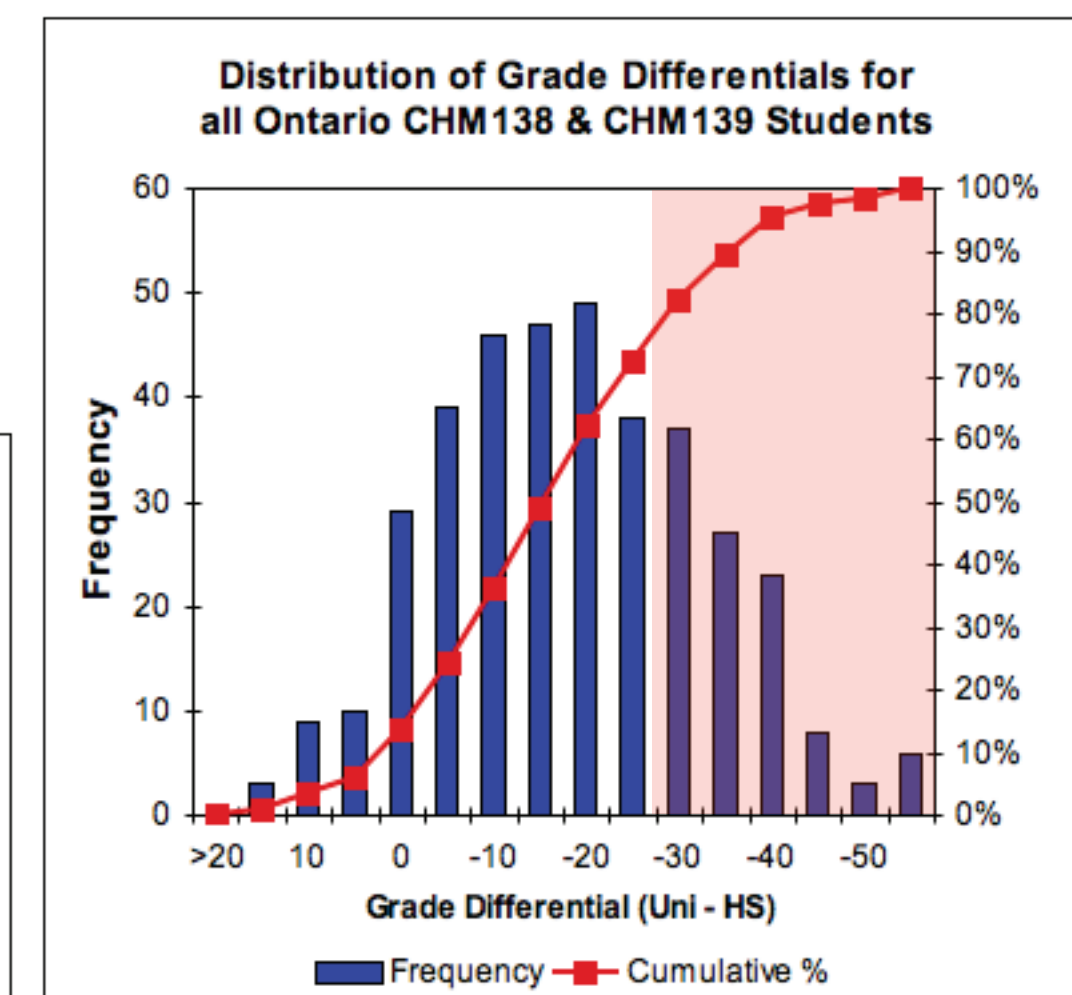
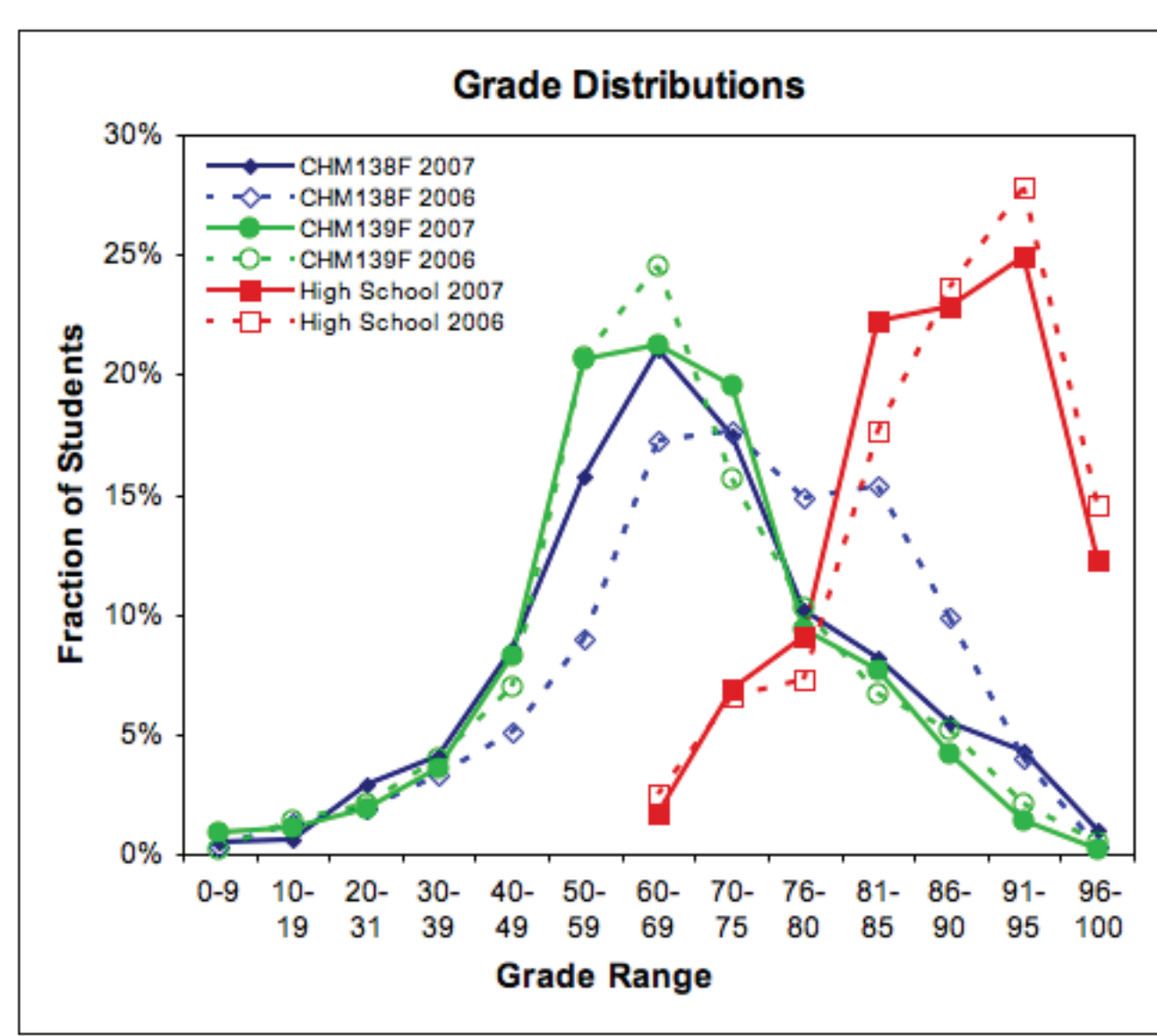
## A Grade Disappointment:

High school students are typically warned to expect a drop of 10–20%. A significant proportion drop **more**.

Grade averages:

CHM138F 2006: 69.7 (n = 959)  
CHM138F 2007: 65.0% (n=1003)  
CHM139F 2006: 63.8 (n = 633)  
CHM139F 2007: 63.3% (n=640)  
High school 2006: 87% (n=317)<sup>4</sup>  
High school 2007: 87% (n=521)<sup>4</sup>

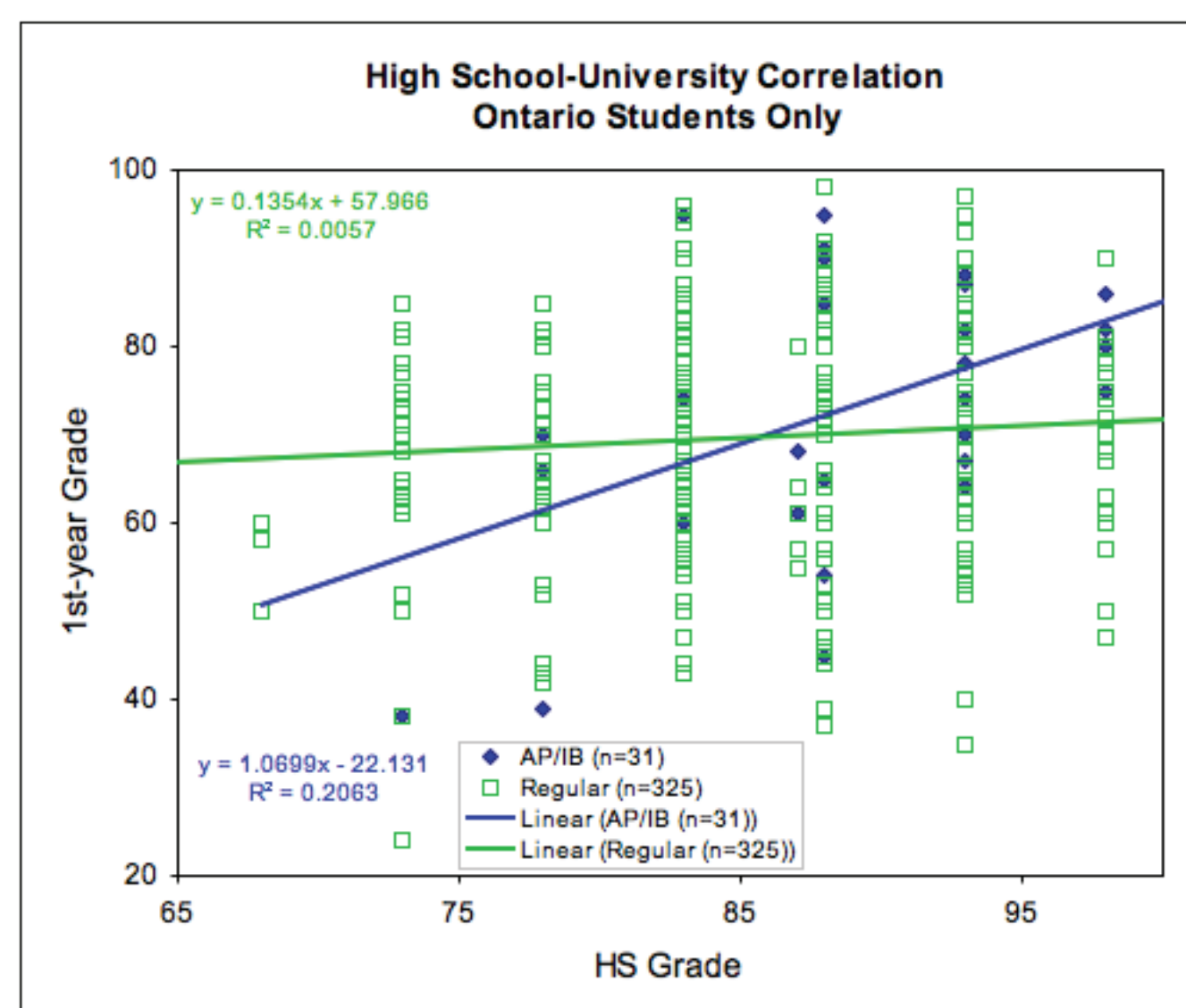
GD = University grade – HS grade



Mean GD (all students) = –16.4,  
s = 14.5, n = 374  
Mean GD (AP & IB only) = –15.9,  
s = 13.5, n = 31

**25% of students drop 25% or more**

- No significant correlation between high school and 1<sup>st</sup>-year grades



Category	n	r	p
All Ontario	478	0.1000	0.029
CHM138F	333	0.0985	0.073
CHM139F	145	0.0872	0.297
Regular	325	0.0755	0.175
AP/IB	31	0.4542	0.010

*"I knew it was going to be hard ... So I put in all the extra effort, and it's really disappointing when you go in for a test and see the grades. Some people have 100 and some have...13"*

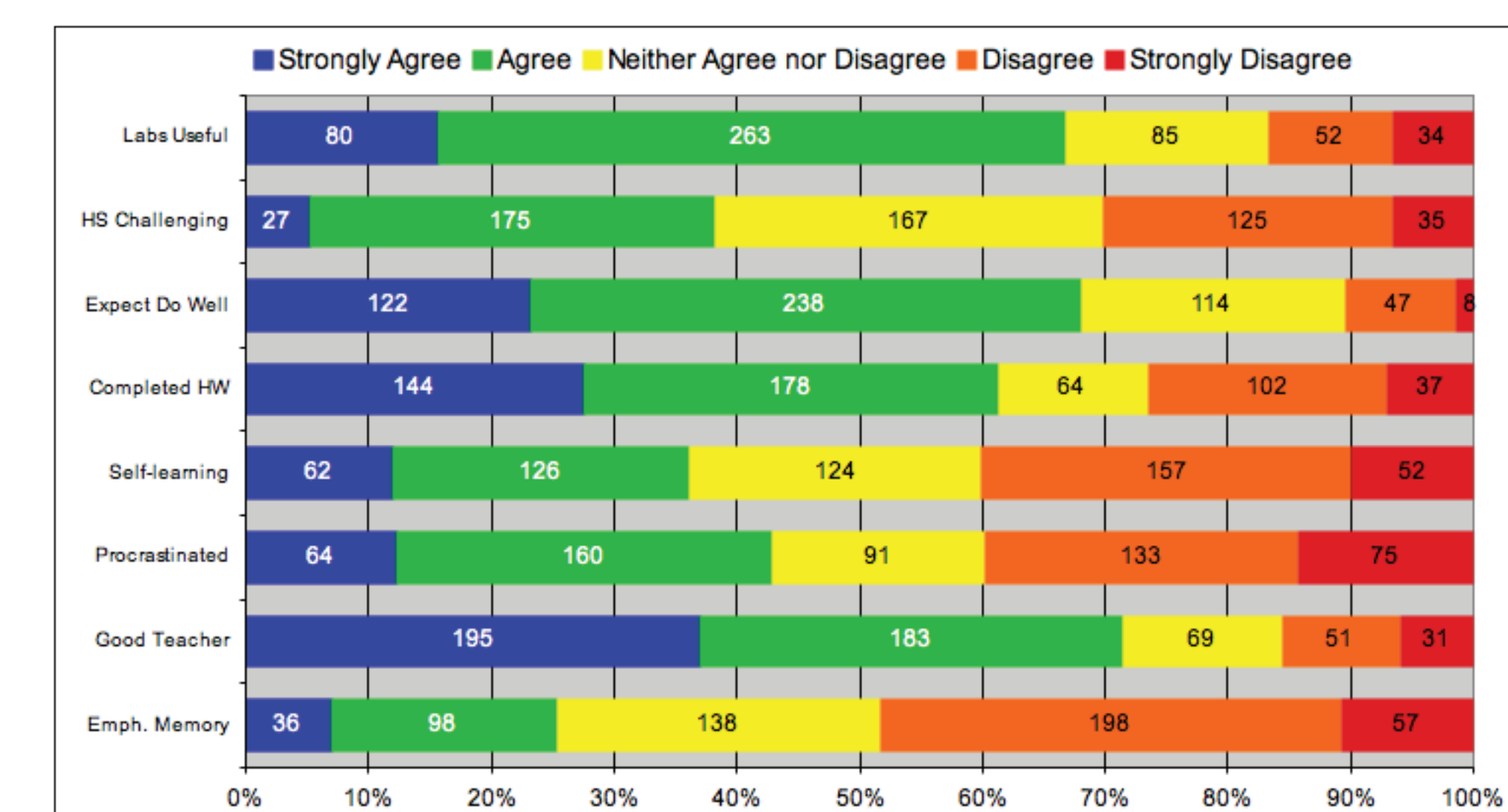
## Methodology:

- An on-line questionnaire (BlackBoard)
- Follow-up small group interviews
- Qualitative & quantitative data analysis

## Recommendations:

- Promote good study skills/habits **early**
  - a student-developed study skills guide is available
- Emphasize problem-solving through small group activities in tutorials
- Introduce more challenging material and problems earlier in courses
- Stagger announcements to avoid “information overload” early in course
- Develop methods to provide more timely feedback on lab performance & reports
- Partner with schools on strategies for teaching & evaluating problem solving

## High School Experience:



In interviews, many students felt high school **should** have been more challenging

**25% feel high school emphasizes rote memorization over conceptual understanding**

**40% do not develop study habits in high school appropriate to university-level education (self-directed learning & time management)**

## Curriculum Coverage:

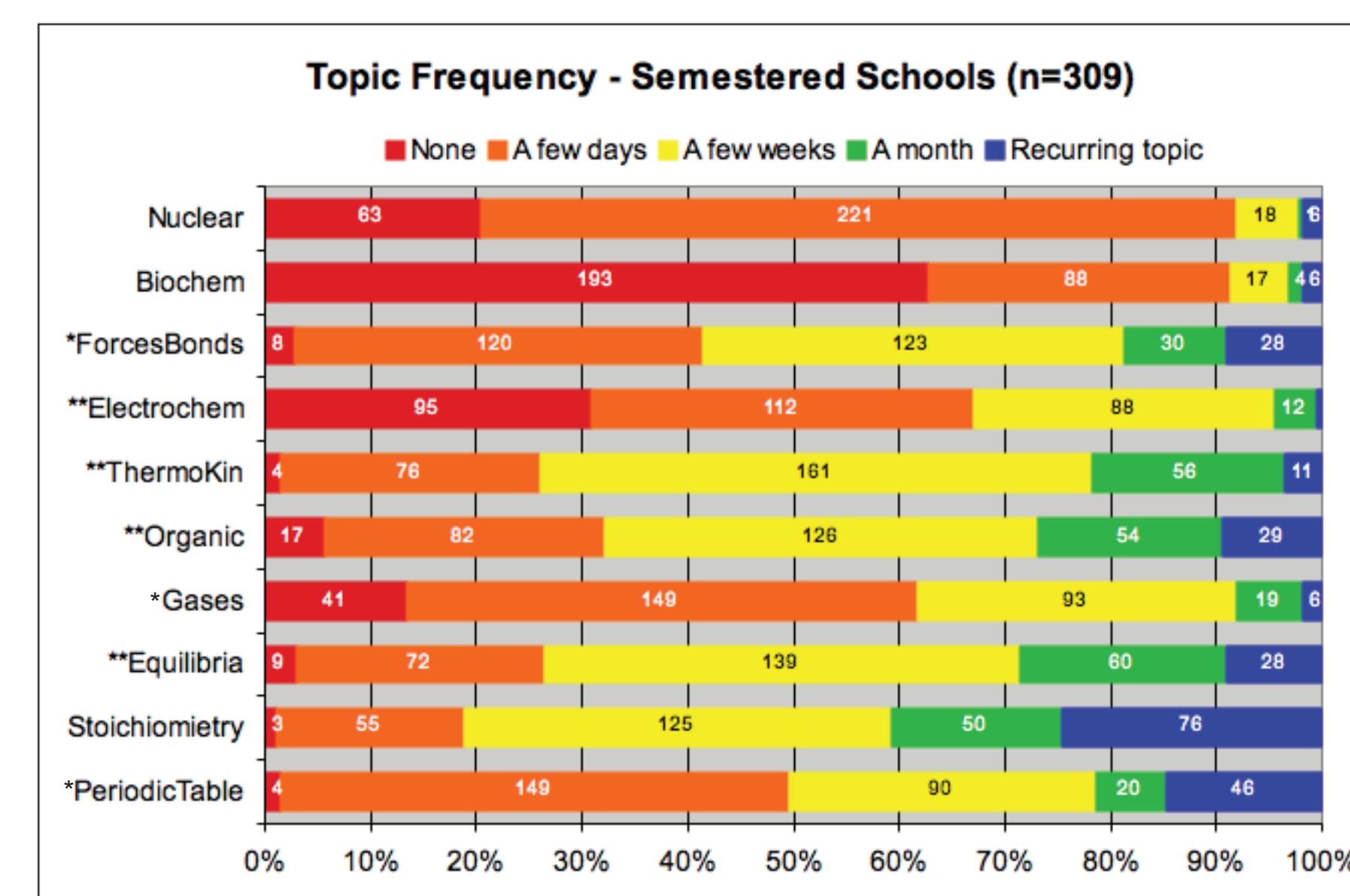
Curriculum topics are based on a similar US study<sup>2</sup> for comparison purposes

— students were questioned relative to their final high school chemistry course

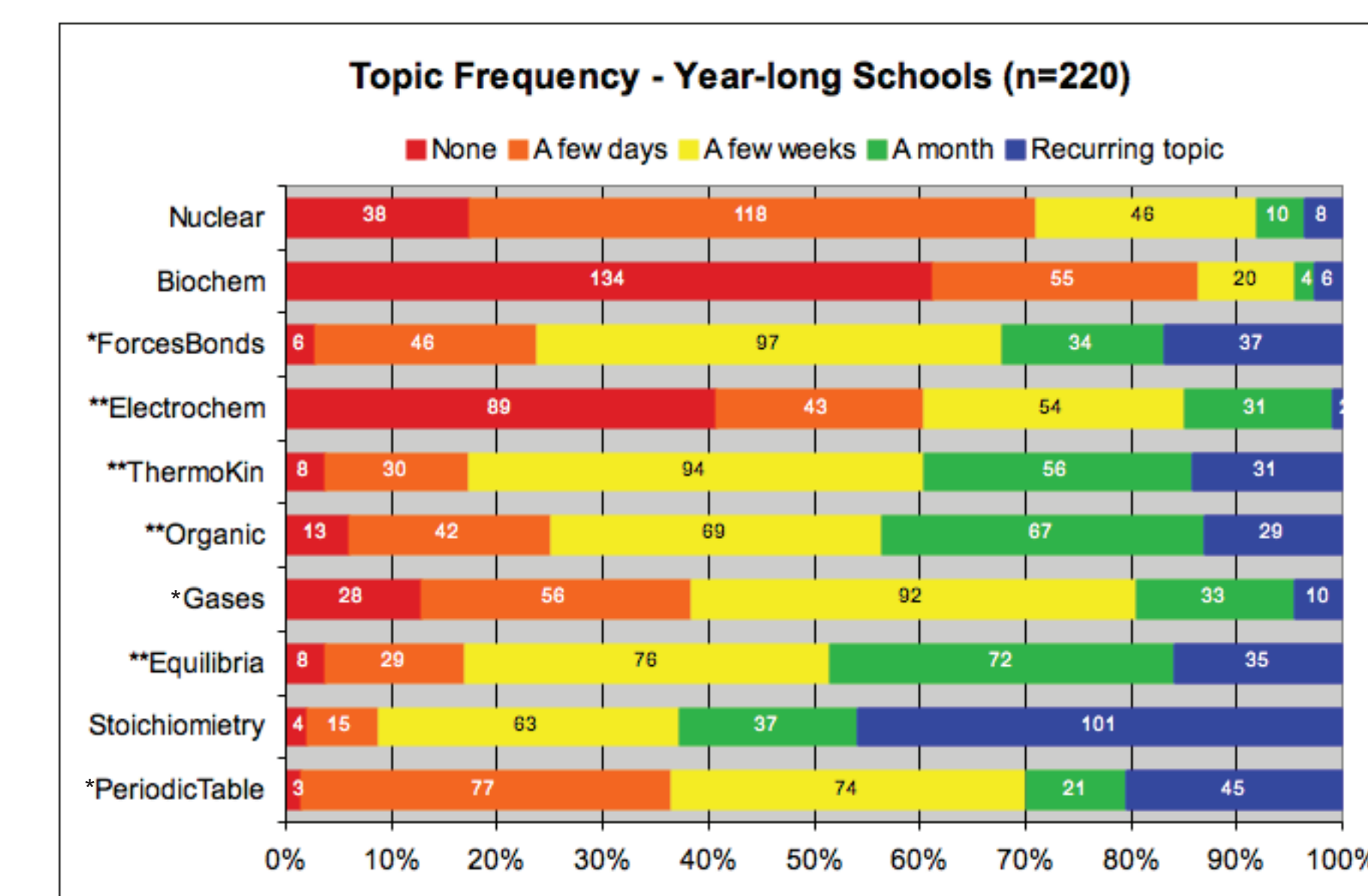
\* these topics are primarily covered in the Ontario grade 11 curriculum

\*\* these topics are primarily covered in the Ontario grade 12 curriculum

*"a lot of memorizing as opposed to understanding concepts"*  
*"I wish high school didn't baby us so much"*  
*"He was a pretty tough teacher, and ... made us write our own notes and ... learn on our own too"*



- CHM139 students typically weak on thermochemistry & electrochemistry; the latter is often omitted in high school
- Although some exceptions, many students report very limited coverage of actual organic curriculum content; in many instances, it is assigned as an independent study unit



*"My teacher totally skipped organic chemistry" [Curriculum reform made]*  
*"the gap between high school and university bigger"*  
*"I'm at a huge disadvantage because my teacher taught a lot of minor things ...especially naming"*  
*"My teacher focused on inorganic chemistry, like, for the whole year ... we started organic chemistry in...May... one chapter, which is self-study"*

## References:

1. Marc Frenette and Klarka Zeman, Statistics Canada Report 11F0019 No. 303
2. R. H. Tai, P. M. Sadler, J. F. Loehr, J. Research Sci. Teaching, 2005, 42(9), 987–1012
3. R. H. Tai, R. B. Ward, and P. M. Sadler, J. Chem. Ed., 2006, 83(11), 1703–1711
4. Admissions average for science students was 87.4% (Fall 2005) & 88.5% (Fall 2006)

## Acknowledgements:

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