INVASION OF THE CLONES: WHEN ADAPTIVE

TECHNOLOGY MEETS THE EMPORIUM MODEL

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Ref: http://devmd.com/wp-content/uploads/2015/08/Attack-of-the-Clones.jpg

WHAT DOES THIS MEAN TO YOU?

Ref: Creative Commons, davidgsteadman
Taken at Gardiner Cup Final, Edinburgh
Sept 27, 2009, some rights reserved.

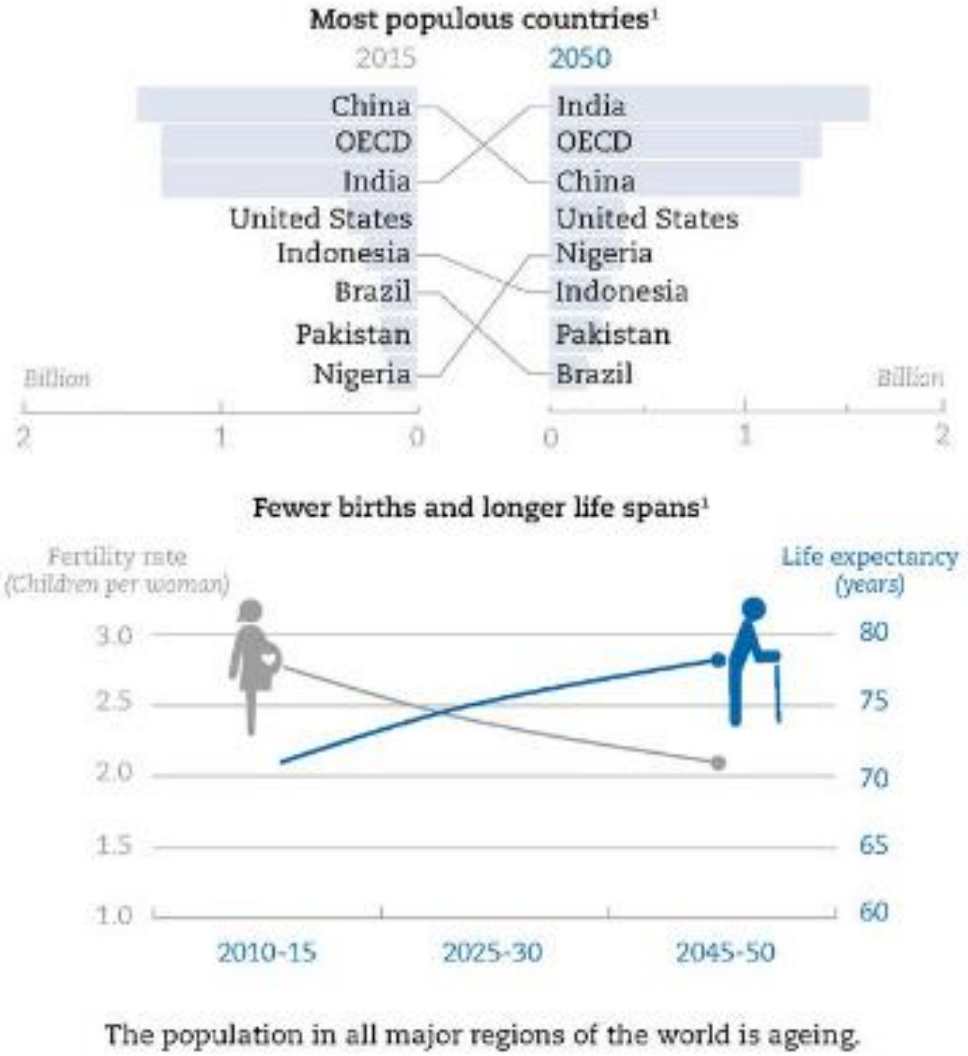
HOW ABOUT THIS?

OECD REPORT OUTCOMES FOR 2016:

"Megatrends affecting science, technology, and innovation"

"AI could auger creative destruction"

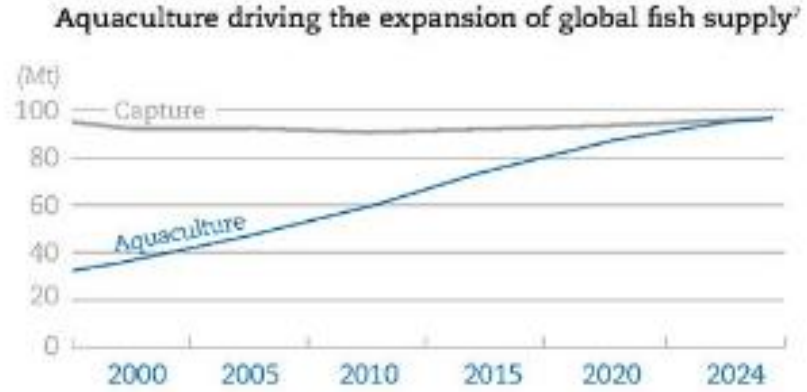
OTHER DEMOGRAPHIC TRENDS

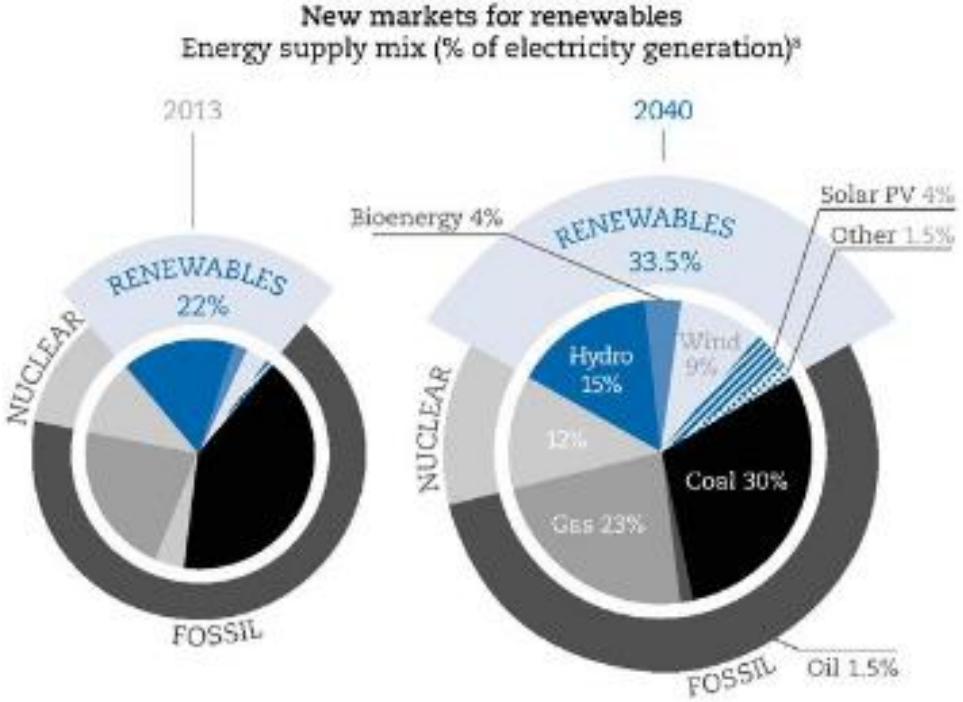


- The population of India is outpacing China and all developed countries
- Women are not having as many children, and as a population, everyone is living longer

ENER ES

- Aquaculture (demand for fish) outpacing capture
- Renewables will replace about half of the coal market in the next 20 years





THE REALITIES OF AUTOMATION

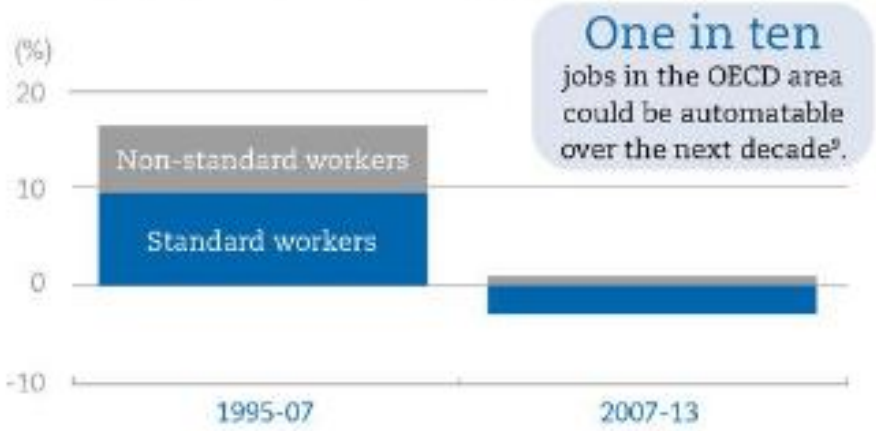
Communication habits by generation[3]

	Silent generation (<1945)	Baby boomers (1945-60)	Generation X (1961-80)	Millennials (1981-95)	Generation Z (>1995)
Aspirations	Purchase of a principal residence	Job security	Work-life balance	Freedom and flexibility	Security and stability
Symbolic product					3D printers, nano-computing...
Attitude towards technology	Disengaged	Early adopters, PCs on the horizon	Computer literate	Digital natives	Dependent on digital technology
Communication channel	Face-to-face	Face-to-face, telephone, email	SMS, email	Social networks, instant messaging	Video calls on devices

- We will see a significant reduction in jobs available because of AI and automation in the next 10 years
- The job market is in flux

- The new generation is DEPENDENT on digital technology

Growing precarity of employment
% employment growth, 2007-13, by type of employment[8]



One in ten jobs in the OECD area could be automatable over the next decade[9].

More than half the jobs created since 1995 are non-standard, i.e. part-time, temporary or self-employment arrangements.

INVESTING IN CANADA'S FUTURE

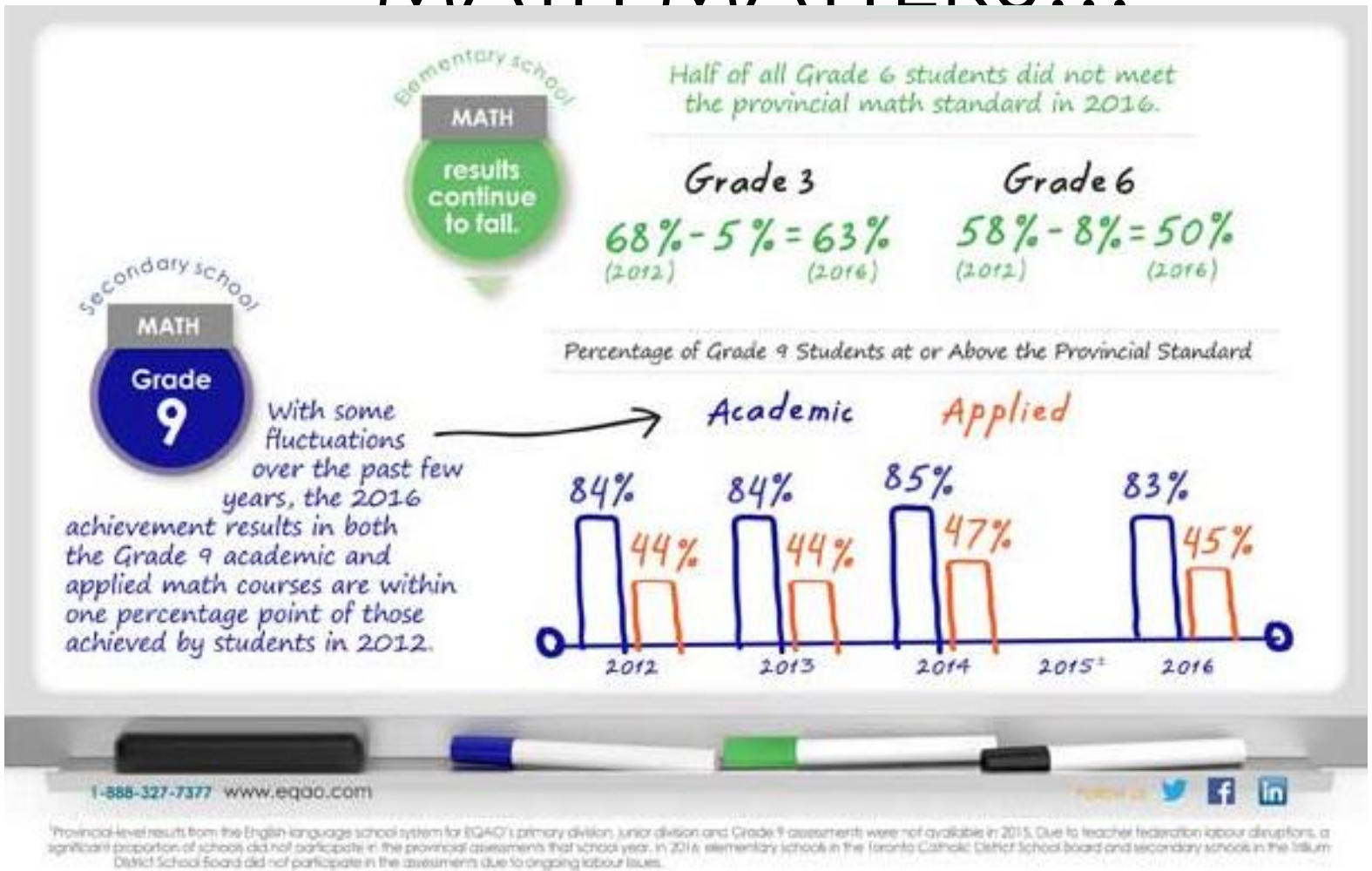
- Canada has made implementing societal challenges a thematic focus of its federal funding(more percent wise than any other country)

Figure 3.8. **Economies are setting R&D budgetary priorities to better address grand challenges**

Share in total GBAORD (%), 2016 or latest year available

MATH MATTERS…

- Math is a problem
- The curriculum in 2009 removed Algebra as a core requisite from grade 9, and divided the prealgebra content across grades 5-8
- **By Grade 9, only 45% of students targeting applied schools are numerate**



http://www.eqao.com/en/about_eqao/media_room/facts_and_figures/Pages/infographic-2016-elementary-grade9-results.aspx

WHICH ONE IS EASIER FOR YOU TO READ?

- The future of Canada depends on building a society of smart, agile students who can perform at their best.

- L'avenir du Canada dépend de la construction d'une société d'étudiants intelligents et agiles qui peuvent faire de leur mieux.

FOR AS MUCH AS DELIVERY NEEDS TO BE ‘IDENTICAL’ EACH STUDENT IS **GROWING MORE AND MORE UNIQUE**.

MANY STUDENTS WILL BE **MISSING DIFFERENT THINGS** FROM THEIR PAST MATH; A ‘VANILLA’ TREATMENT MAY NOT BE THE BEST OR ONLY ONE…

UDL

"the most common approach to curriculum design is to address the needs of the so-called "average student." Of course **this average student is a myth**, a statistical artifact not corresponding to any actual individual.

But because so much of the curriculum and teaching methods employed in most schools are based on the needs of this mythical average student, they are also laden with **inadvertent and unnecessary barriers to learning**." - Anne Meyer

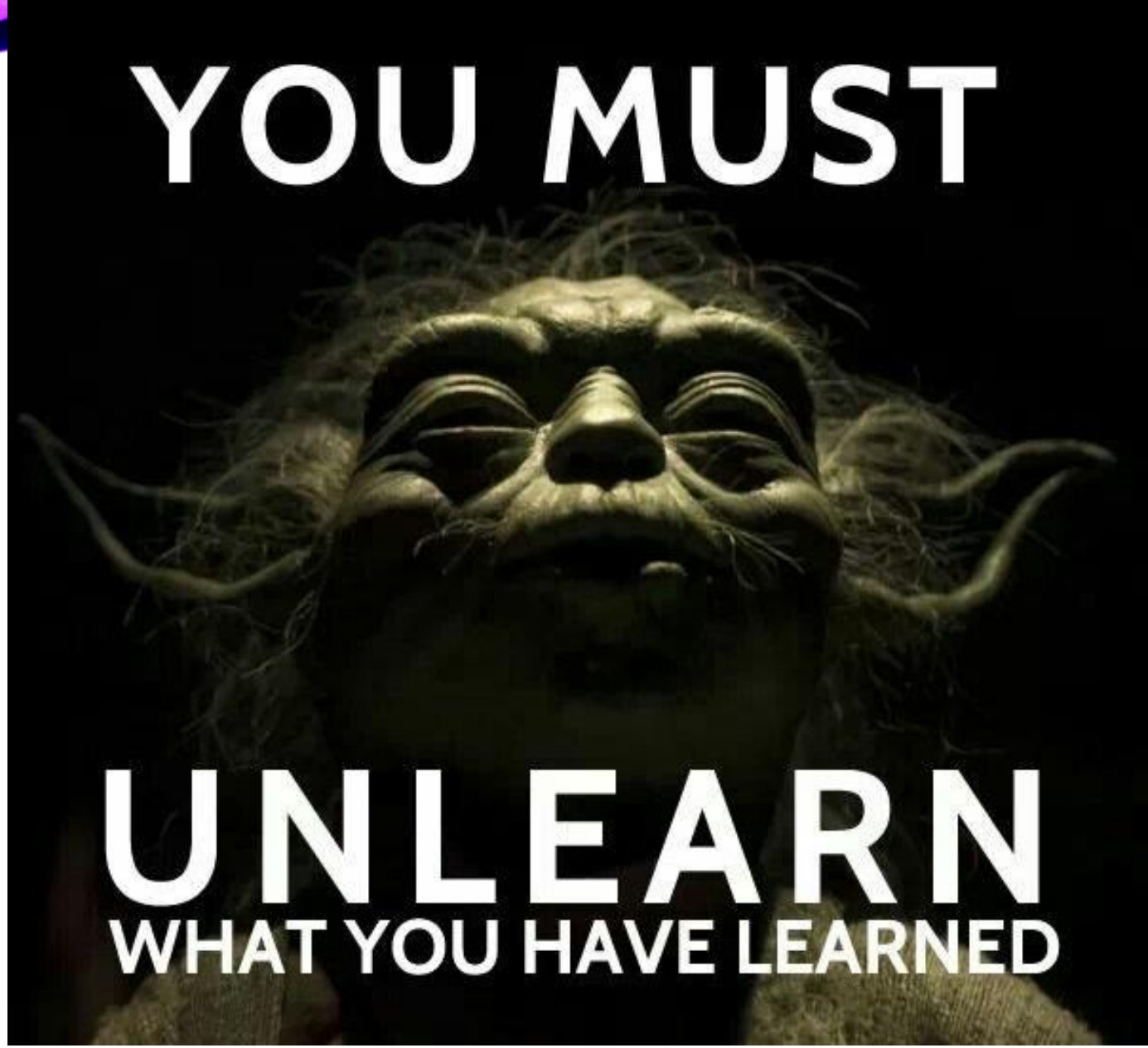
Ref: http://www.cast.org/about/board/anne-meyer.html#.WRnoc4jyuCo May 5 2015

Ref: Universal Design for Learning: Theory and Practice
by Anne Meyer
Feb 26 2014, CAST Professional Publishing

AODA ACCESSIBILITY STANDARDS

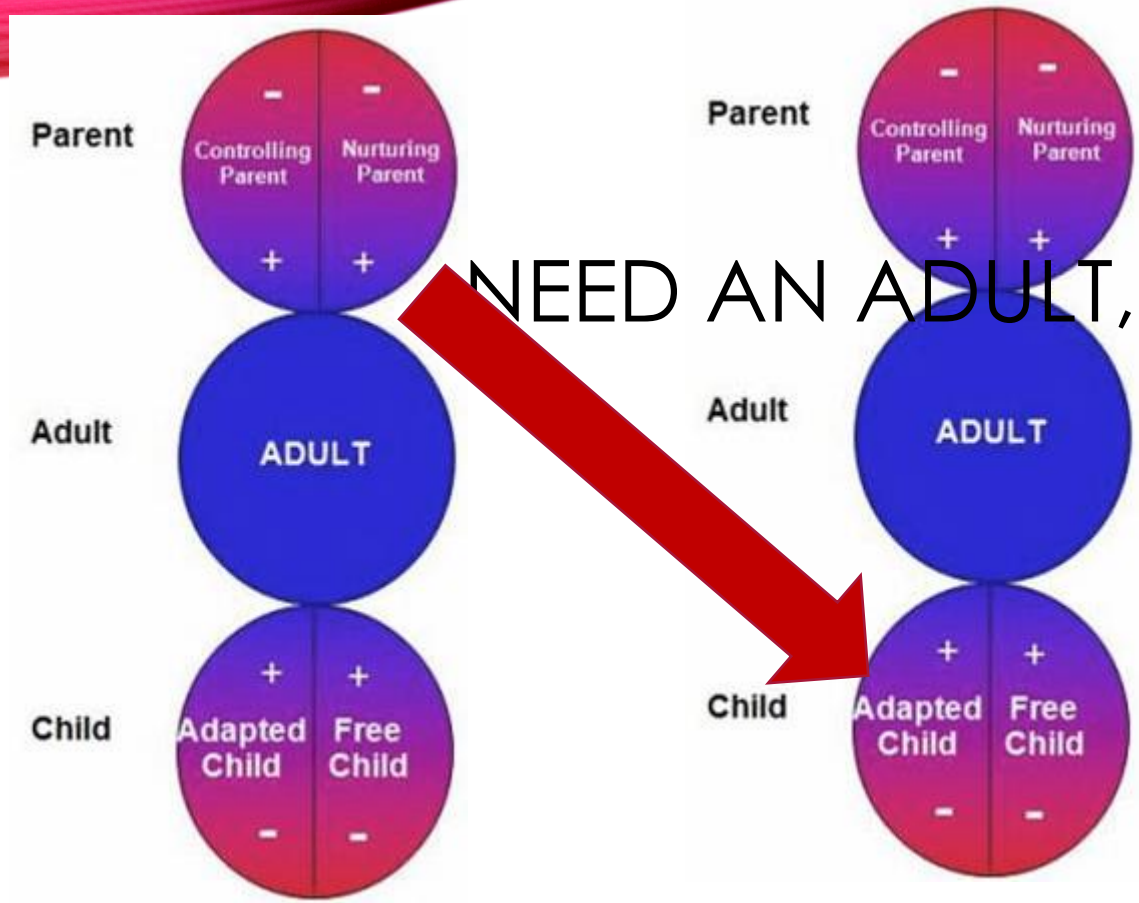
What does it mean for math?

MY CONCLUSION…



https://s-media-cache-ak0.pinimg.com/736x/80/3e/86/803e86052f46b83569a8942c976057b9.jpg, May 15, 2017

EGO STATE MODEL TRANSACTIONAL ANALYSIS



NEED AN ADULT, NOT A

"Give a Man a Fish, and You Feed Him for a Day. Teach a Man To Fish, and You Feed Him for a Lifetime"

-Unknown

http://www.crowe-associates.co.uk/coaching-and-mentoring-skills/transactional-analysis/

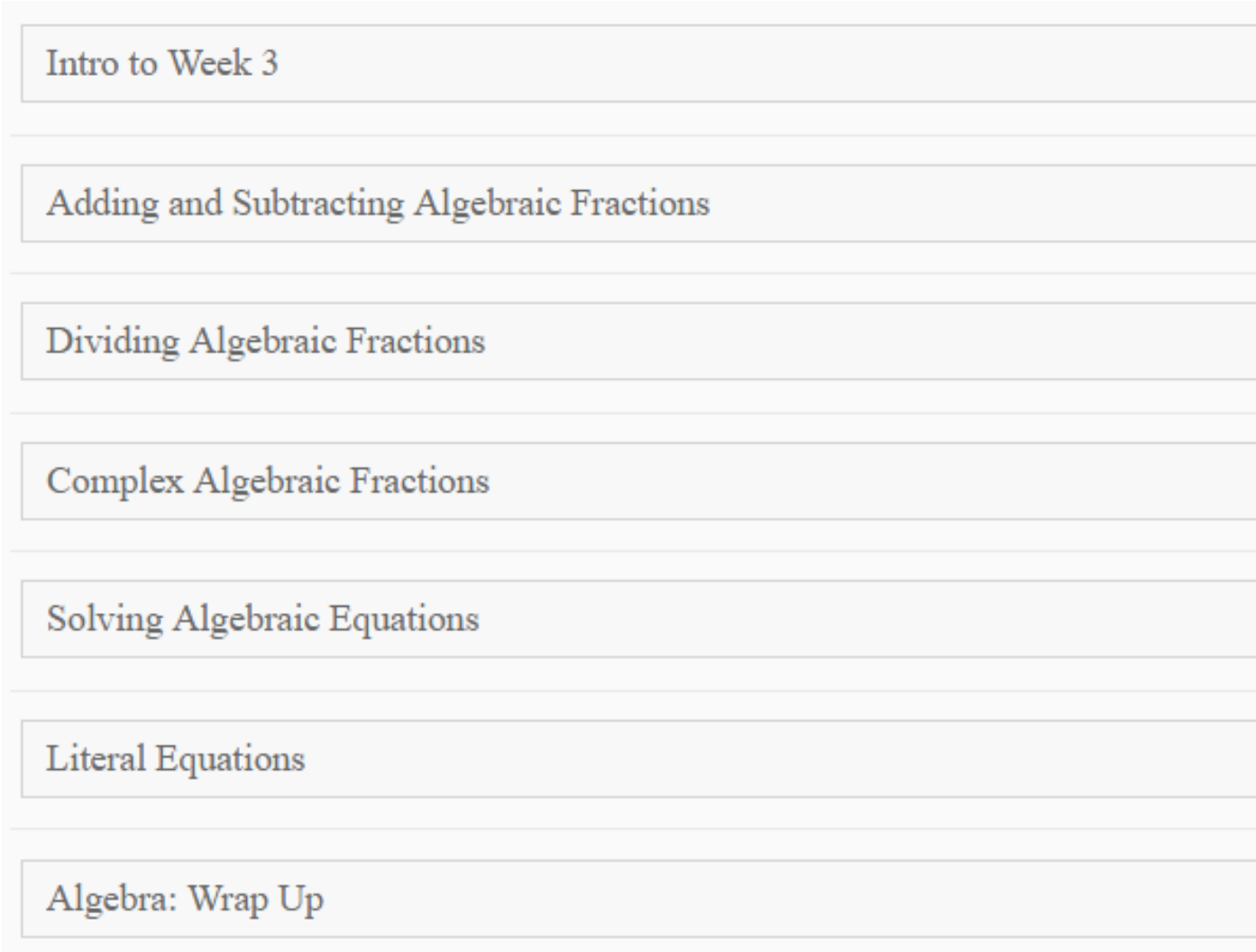
Model origin: Eric Berne, Games People Play, 1964

MY STRATEGY FOR MA179

- Design A Class Students Can Work Through at Their **Own Pace**
- Design Options to suit a **range of abilities**
- Provide supporting materials for **self study** outside of the classroom
- Leverage Technology to provide remediation and **fill in the 'gaps'**
- **Leverage my time where it is most** needed while in the classroom

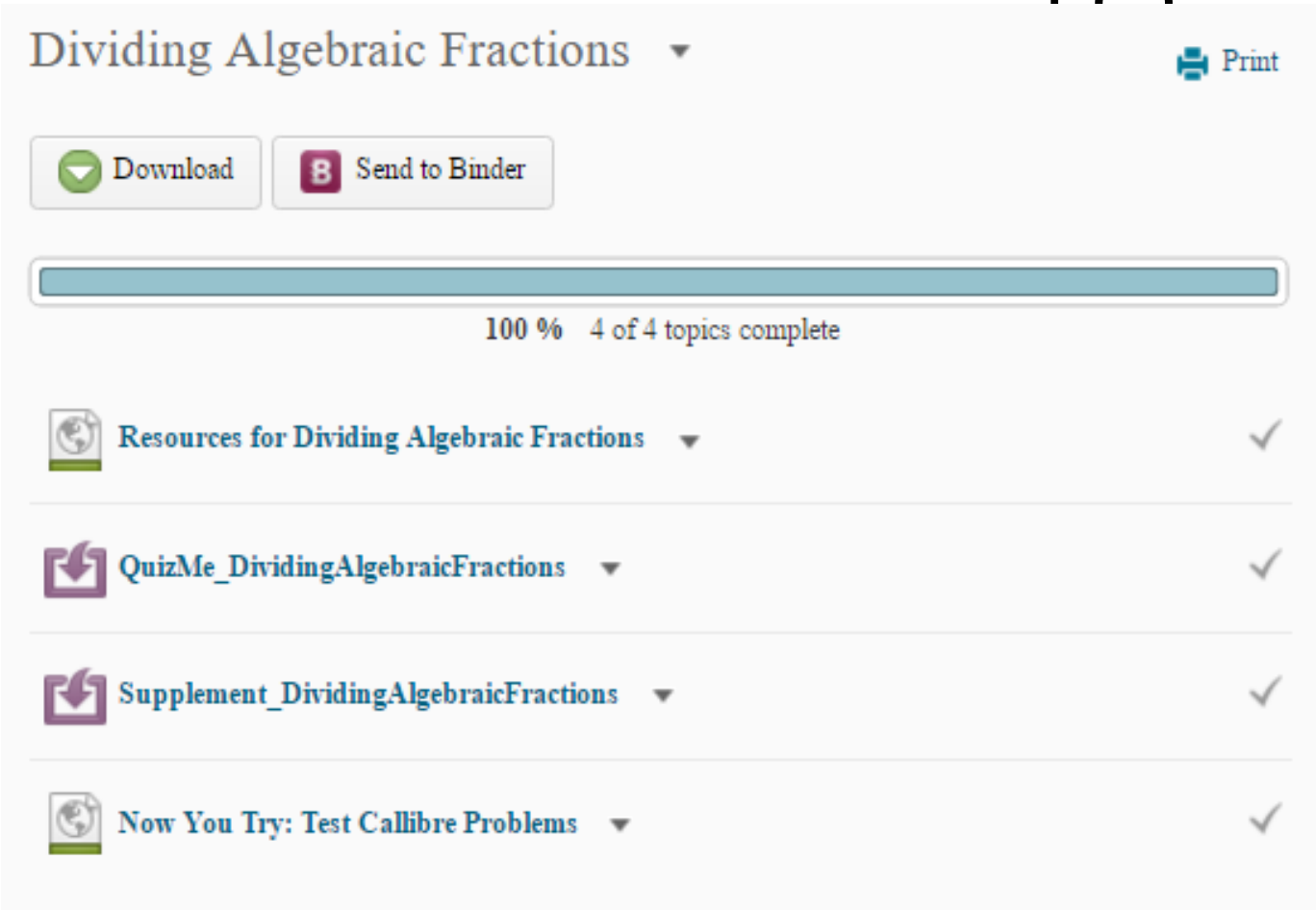
THE WEEKLY ASSIGNMENT

- Each Week was **split into a series of learning outcomes**
- Because semester 1 math is considered "review", approximately **5 LOs are covered per week**
- Practically, we find many students ill equipped to do this math without practice



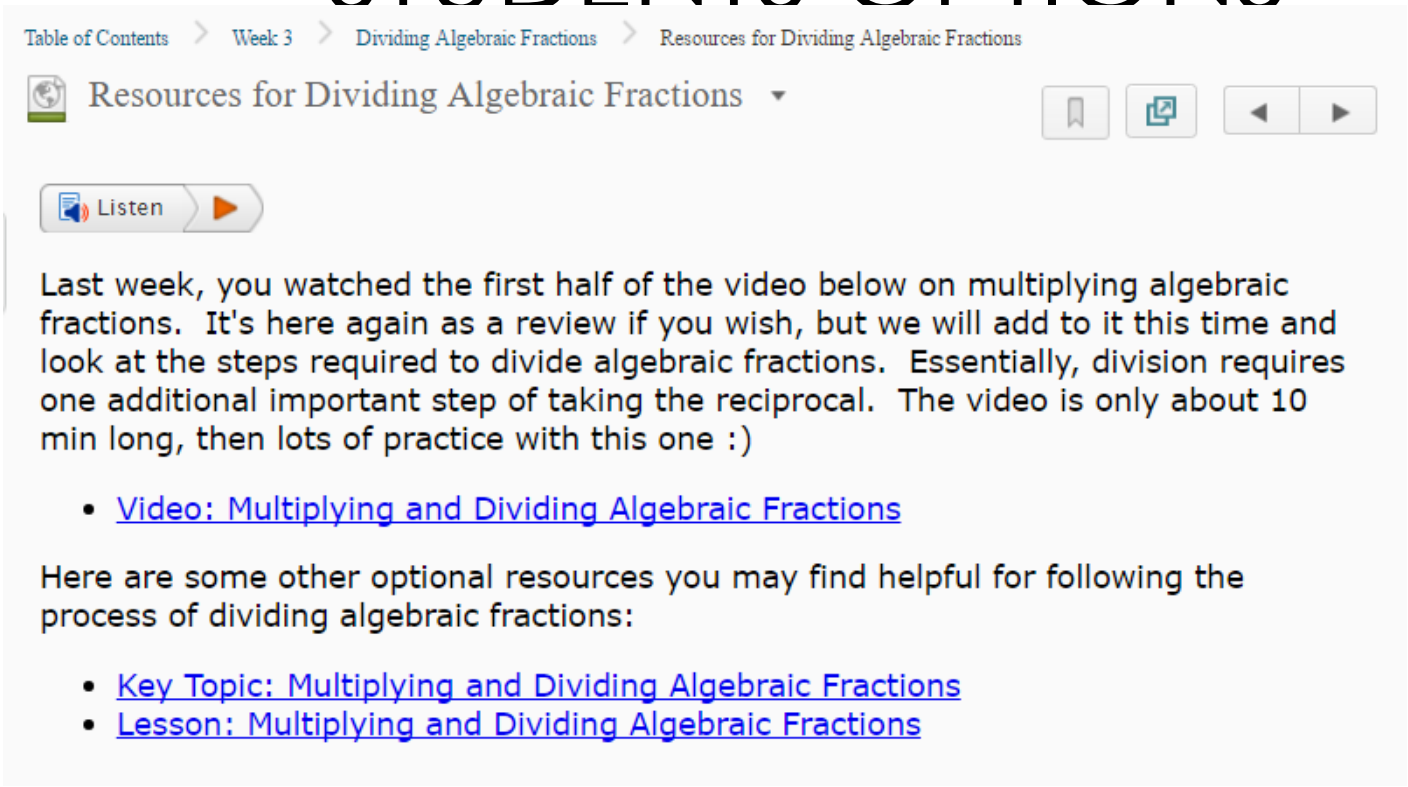
ELEMENTS PROVIDED FOR EACH LO

- a **resource toolkit** for self study
- an optional quiz they can take to "**test out**" of that skill
- a supplementary set of guided questions to **skill build**
- a now you try feature with problems that look similar to **test callibre**



RESOURCES FOR STUDY OFFERED STUDENTS OPTIONS

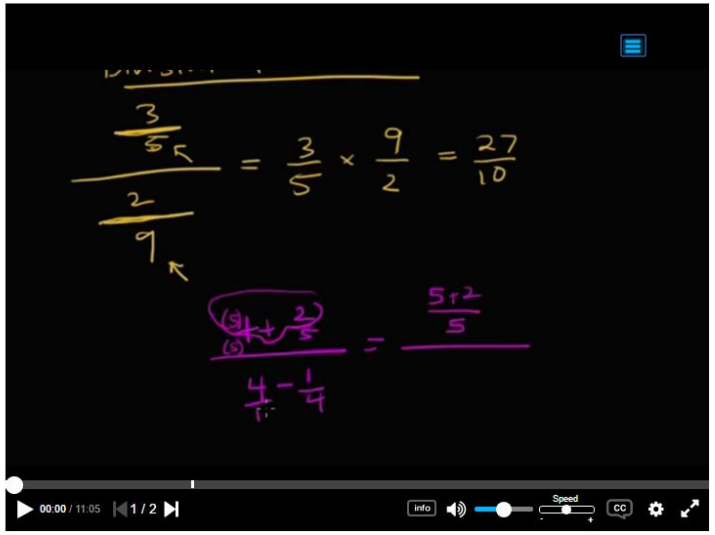
- Lessons were **defined by the instructor** and included options:
- **Video** was predominately suggested because it "shows" students how to work through process steps
- **Key Topic sheets** provided a 'cheat sheet' showing the summary of rules or new ideas in an abbreviated form
- **Lessons** provided more lengthy learning arcs



THE ACCESSIBLE RESOURCES

AODA compliant player with lessons in conjunction with publisher

Multiplying and Dividing Algebraic Fractions



KT are compliant, viewable as html5 but also fully printable as pdfs

T.2 Intermediate Algebra Skills – IA.6 Algebraic Fractions
Key Topic: Multiplying and Dividing Algebraic Fractions

DEFINITION: ALGEBRAIC FRACTIONS

An algebraic fraction is a mathematical statement that has a numerator and a denominator that may have numerical or algebraic factors and terms.

Here are a few examples: $\frac{2x}{4+x}, \frac{3x^2+4x-3}{2x^2-4}, \frac{3}{2}, \frac{3x^3y^3}{5xy^7}$

As you can see, often these fractions present an unknown value in a complicated way that can make it hard to see relationships or solve problems. For this reason, in this key topic sheet, we will outline methods for simplifying algebraic fractions.

Before attempting this section, please review the rules for exponents, factoring, algebra, and basic operations using fractions. These core skills will all be used to solve algebraic fractions. If you find you are not able to complete the algebraic fractions, or feel overwhelmed, it is typically because you require more work on one of the prerequisite skills.

MULTIPLYING ALGEBRAIC FRACTIONS

Stepwise process:

1. Factor each fraction first if possible.
2. Multiply numerators to get the resultant numerator; multiply denominators to get the resultant denominator.
3. Simplify by cancelling like multiplies from the numerator and the denominator.

Example: Multiplying Algebraic Fractions

Simplify the following to prime factors:

$$\left(\frac{x^2-1}{2x+6}\right)\left(\frac{x+3}{x^2+3x+2}\right)$$

Step 1: Factor fractions first.

(Note: DO NOT MULTIPLY THROUGH—it will result in an ugly mess!)

Left numerator factors: $x^2-1=(x+1)(x-1)$

Left denominator factors: $2x+6=2(x+3)$

Right numerator factors: $x+3$ is already prime

Right denominator factors: $x^2+3x+2=(x+1)(x+2)$

Lessons are more compartmentalized, and make use of html5 features like dropdown so students can explore content in smaller elements and compare differences in examples

Lesson: Multiplying and Dividing Algebraic Fractions

Simplifying a Single Fraction

When we have a single fraction, it is typically useful to see if the fraction can be simplified on its own as a first step. To simplify, first factor the numerator and the denominator separately and then look to see if there are any common factors that can cancel.

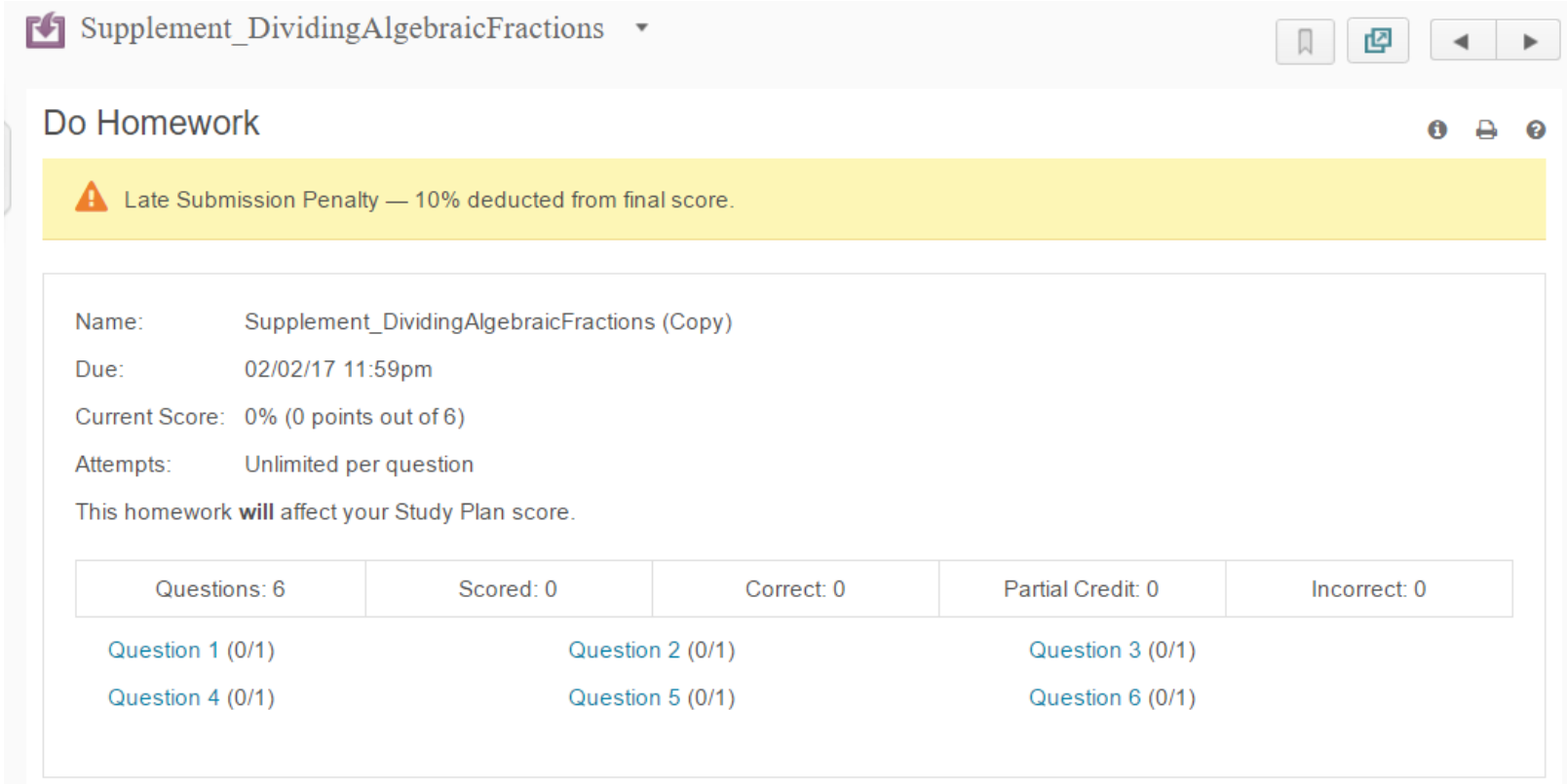
Examples:

- Example 1
  - Simplify $\frac{10}{42}$
  - $\frac{\cancel{2}\cdot 5}{\cancel{2}\cdot 3\cdot 7}=\frac{5}{21}$
- Example 2
- Example 3
- Example 4

QUIZME AND SUPPLEMENTS: TWO WAYS TO "DO"

- QuizMe's were short- typically 2-4 problems. Students had to get 80%+ to get credit- and **only got 1 attempt**.
- Supplements had more questions to bridge learning with **lower level skills in the learning arc.**
- At the point students were doing a supplement, they knew there was a **cognition issue in doing the harder problems-** this improved their buy in that the work was needed.

Link from LMS directly into assignment:



CLA

Class conducted in a microlab

Many Students opted to **self study*****

My time was spent working ensuring students were making progress, intervening where they were getting stuck, and **addressing their problems**

Students became **more independent** as the semester progressed

No two students were working on the same thing at the same time.

Encouraged collaboration, problem solving, **self sufficient growth**, independence

Made **work ethic issues** and **challenges using technology** extremely obvious

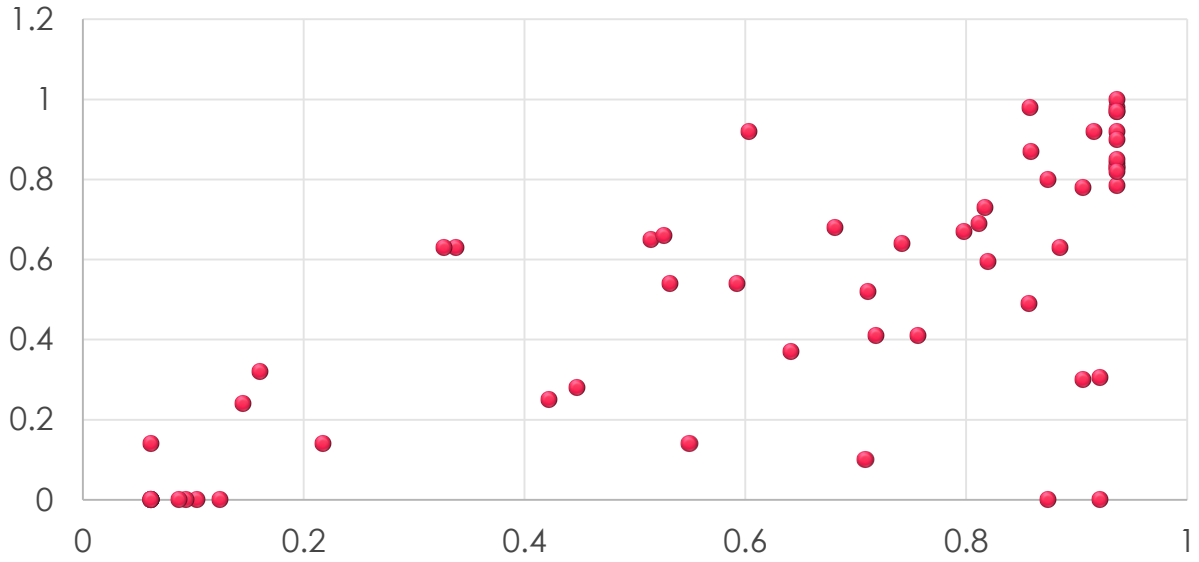
Ref: HackNY.org, Matylda Czarnecka, hckNY spring 2013 student hackathon

IMPORTANT THINGS TO KNOW ABOUT THIS PILOT

- Students got the **higher of their 2 marks** (Quizme or Supplement)
- Students were advised to **shoot for a min of 80%** to demonstrate skill mastery at an appropriate level

- Assignments were only worth **12%**
- In Class attendance was not great, especially in last 3 weeks of the term

Test #1 Scheme Symbol on Y axis, Homework in Weeks 1-4 on X axis



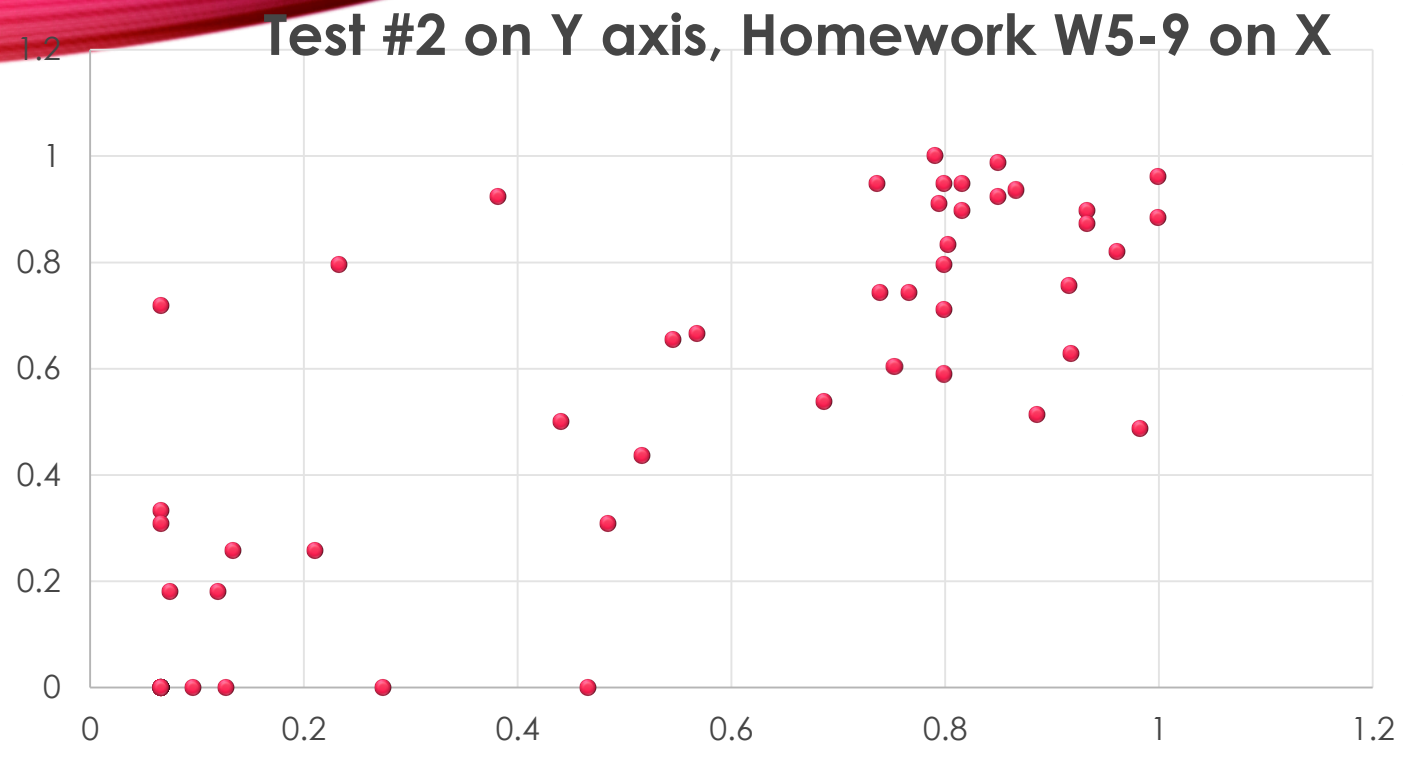
W1-4 is notoriously bad for low participation rates

Some students try to 'memorize' math; this shows up in W1-4 as a group who do very well on the practice but not as well on the test

From this graph, what is clear is that if students didn't study to the 80%+ that was required in the class, they were not likely to pass.

PRACTICE IN W1-4 was crucial to Test1

*****Algebra is not taught as an intact module in high school anymore (or elementary for that matter)**

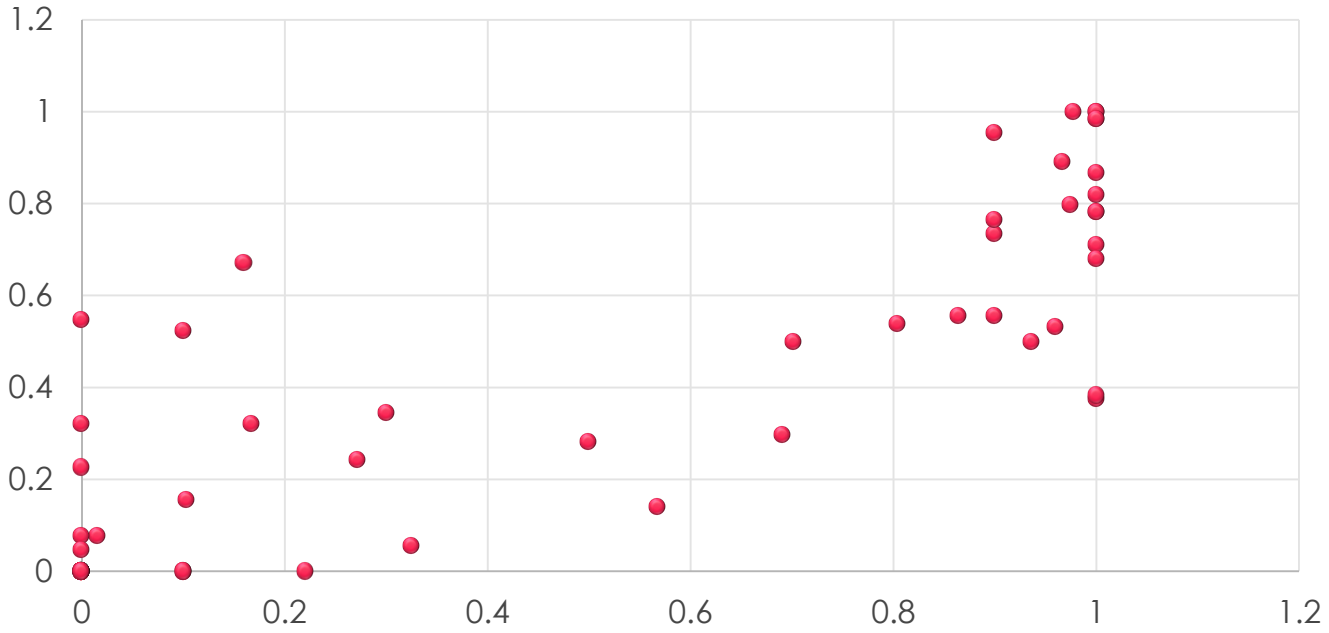


W5-9 begins to show a clearer trend- those who did the work passed, but those who didn't do the practice didn't succeed.

This is a clearer trend than in the past, where even strong students skipped homework because of their length and their preconceived notion of their skill

PRACTICE IN W5-9 was crucial to Test2

*****Trigonometry, about 1/3 of this test, IS covered as an intact module in secondary schools**



W10-13 shows how **those who studied once again passed**. Again, this is a clearer trend than in the past- illustrating that the options provided gave those who have the skill an opportunity to demonstrate them.

Overall conclusion: Those that took the class passed

Those who didn't take the class did not pass.

Student Feedback- The Good p1

“This instructor puts a great deal of effort in producing her video lectures for each weekly topic. The videos are comprehensive in scope and I only rarely felt I didn't have enough info after learning from them -- for example **it was rare that I received less than 100% on a QuizMe**.

Any challenging topics were quickly **clarified by {the instructor}** by email or a short office visit. **During class, concepts not understood by the student are easily answered and explained with examples.** The instructor strongly encouraged the PASS program which I have benefited from greatly. Elizabeth is an excellent instructor and goes to great lengths to help her students succeed.

For a first run at a 'mostly' blended-learning approach, the course material was delivered effectively. The video lectures allowed the instructor to **convey concepts in detail at her natural pace and without disruption**, such as those that would happen in the classroom.”

Student Feedback- The Good p2

"The instructional videos that were posted online were very thorough and she always gave **a recap of what we should know and then built on that** material allowing for an **easy transition onto the new material.**

She was always **willing to help in class** if we had any questions, was quick marking the tests and always available for feedback if you want. She was very good at **reminding the student of the course timelines** and making sure that everyone knew what was happening, and when assignments were due."

"{Instructor} took the time to make videos for us to go through at home, allowing for us to **go through the lesson plan as many times as necessary**. The online information was well organized."

"–Provided students with many resources to aid in learning course content
-Fully explained course concepts through the use of blended learning and **reinforced that knowledge with face-to-face instruction**
-Gave students **multiple ways to succeed"**

Student Feedback- The Not So Good p1

(**The Gradebook was in pilot form-** they didn't like that they had to login to another page to see their mark during the term- will be remedied once publisher software is updated it he upcoming year)

What did you like LEAST about this course?

Comments
noting
Nothing.
nothing
I found some of the videos a little hard to follow at times, and when i would ask for help in class, i would often be referred back to the videos. Which left me trying to find my own ways of understanding concepts.
The grading structure was a little unclear. Each concept discussed in the course had a corresponding quizme/supplement assessment to be completed for marks. For each concept you could do one or the other or both depending on your comfort level with the material and the highest grade of the two would go on record. The quizme was a one chance assessment and the supplement was not only universally easier but also gave you infinite chances to achieve a perfect score. This made the grading feel a little too easy and it almost begged the question of another unexplained factor that went into grading (ex. supplement worth 0.3% and quizme worth 0.7%). This couldn't be confirmed or denied by looking on the "grades" tab on elearn and the learning plan showed no indication of how students were being evaluated throughout the course.

Student Feedback- The Not So Good p2

One (of 58) indicated a preference for conventional lectures

Some students felt I should 'teach to the test' more than I did- I don't agree at all.

A few pointed out some areas for growth in our online question bank. **None of this speaks to the method of delivery being bad.**

What did you like LEAST about this course?

Comments
online assignments because it is difficult to write mathematical answers
how it is online, i would rather attend lectures to learn.
nothing
The triangle solving zinger that appeared on Test 2 because I was not entirely prepared or practiced for this type of question based on the available study resources provided. I did not get the right answers for it but my approach was mostly correct so I will get some part marks. After the Test I went to the LSC and consulted the help of Laura, a U of Waterloo math student on staff, and learned the correct solution for the problem. I'm glad this happened because it keeps students on their toes; if my algebra skills were as sharp on Test 2 day as they were on Test 1 day I would have had no problem on solving this question. It was a good reality check.
Not enough people coming to class.
The lessons (videos) sometimes do not focus on what is being tested for.
lengthy questions
I wish there would be more questions available for complex numbers and the later lessons in the term rather than just the supplement.

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Notice that their complains are largely about setting standards for content- and not on disliking the content itself.

LESSONS LEARNED

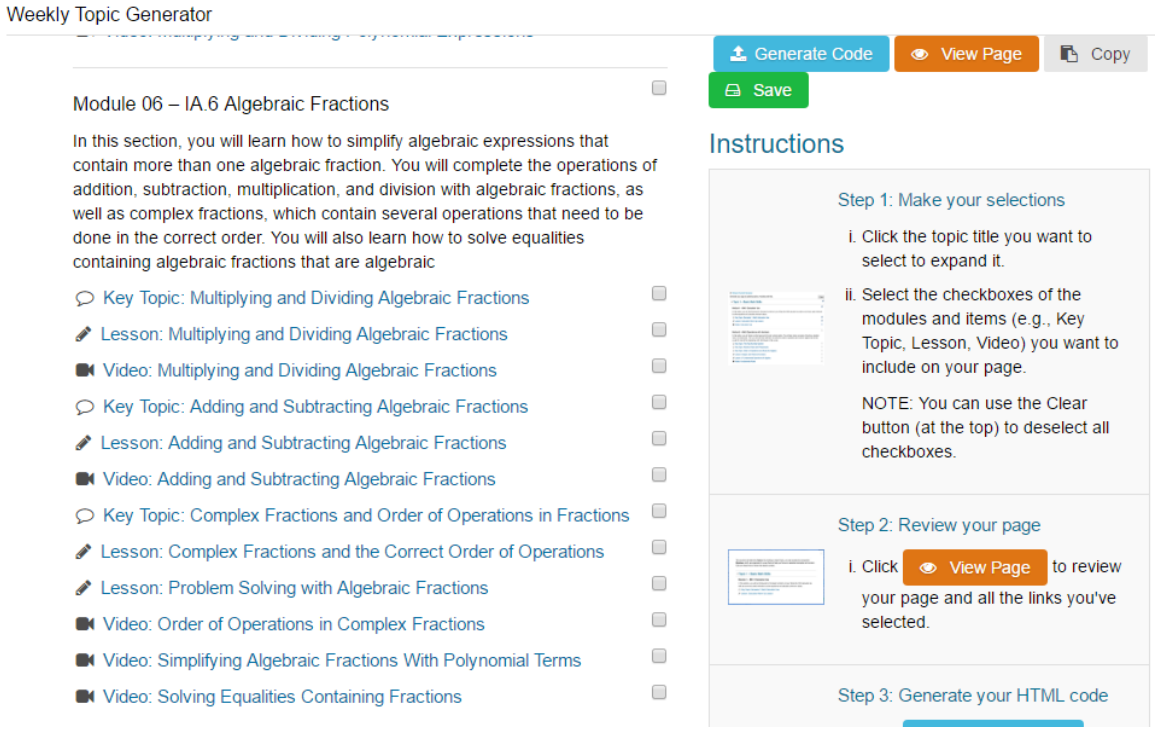
Some form of an attendance (or completion) mark to encourage the desired behavior of ongoing practice vs. cramming

May not be scalable for Fall semesters without rethinking the support model

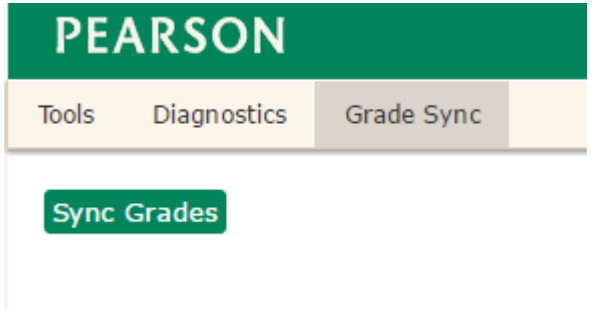
No two students are alike- **this approach did help**, and is a valid way to provide alternatives.

BUILDING TOOLS FOR INSTRUCTORS IS PART OF THIS…PARTNERING WITH OUR PUBLISHER (PEARSON CANADA) MAKES THIS POSSIBLE

Content Selection Tool developed by Pearson Canada to allow for flexibility in picking content items



Grade Book Transfer Tool Implemented



LMS direct assignment linking integration is in progress for D2L to eliminate LTI custom links like this!