

Just-in-time teaching

Jan-Fredrik Olsen
Lunds Universitet

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WHAT IS JUST IN TIME TEACHING?

- ▶ It is a part of the flipped classroom.
- ▶ "Smart" use of homework.

[Läxor i svenska skolan döms ut | Inrikes | SvD](#)

[www.svd.se/.../laxor-i-svenska-skolan-doms-ut_861...](#) ▼ [Oversett denne siden](#)

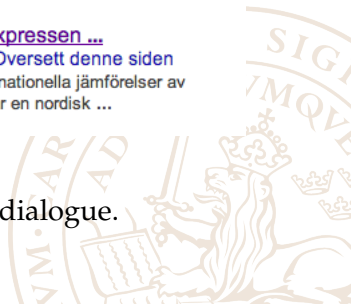
14. okt. 2013 - Svenska skolresultat rasar i internationella jämförelser, Finland finns bland tio-i-topp-länderna. Nu visar en nordisk rapport att svenska lärare arbetar med läxor ...

[Forskare: Svenska lärare usla på läxor | Nyheter | Expressen ...](#)

[www.expressen.se/.../forskare-svenska-larare-usla-p...](#) ▼ [Oversett denne siden](#)

14. okt. 2013 - STOCKHOLM. Finland tillhör toppländerna i internationella jämförelser av skolelevens resultat medan elever i Sverige halkar efter. Nu visar en nordisk ...

- ▶ General philosophy: Homework as a dialogue.



DEVELOPPED BY GREGOR NOVAK ET AL (1997)

Professor emeritus in physics, IUPUI, Indiana, USA.

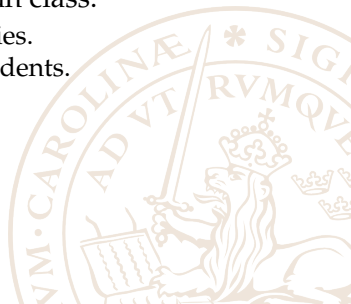
Initial motivations:

- ▶ Help evening class students (1960s).
- ▶ Help students with other majors (1970s).
- ▶ Use computers to individualize learning (1980s).
- ▶ Improve communication skills (1990s).



MAIN FEATURES OF JITT

- ▶ Homework to be handed in ahead of class (< 24 hrs).
 - ▶ Collected using some online system.
 - ▶ Open ended.
 - ▶ Not too time consuming.
- ▶ The teacher uses the homework to plan class.
 - ▶ Common understanding of difficulties.
 - ▶ Makes the class more relevant to students.
 - ▶ Strategies for student participation.



EXAMPLE OF A JITT QUESTION

Minitest inför lektionen måndag 4/2

Arbeta med det förberedande materialet till lektionen på måndag (finns på sista sidan av föreläsningsanteckningarna torsdag 31/1). Svara därefter kortfattat på följande frågor så gott du kan:

1. Förklara med ord (så att din mormor förstår) vad som menas med följande utsaga: $|x-2| < 1$ medför att $|x-4| < 3$.
2. Låt $f(x) = x+3$. Jag hävdar att $\lim_{x \rightarrow 2} f(x) = 3$ då x går mot 2. Du är skeptisk, men du gör ändå ett försök på att bevisa detta med epsilon och delta. Förklara vad som kommer att gå snett. (Experimentera gärna med "Geogebra applet: Intuitive notion of the limit".)



CLAIMED EFFECTS OF JITT

- ▶ Help the students stay up to speed.
- ▶ Give sense of ownership.
- ▶ Develop communication skills.
- ▶ Reflect on their own learning.
- ▶ Deep learning rather than surface learning.
- ▶ Curiosity.

See, e.g., Simkins and Maier (Eds.). (2010). *Just-in-Time Teaching: Across the Disciplines, Across the Academy*, Stylus Publishing. Sterling, VA: LLC.



DOES JITT COUNTER STUDENT ATTRITION?

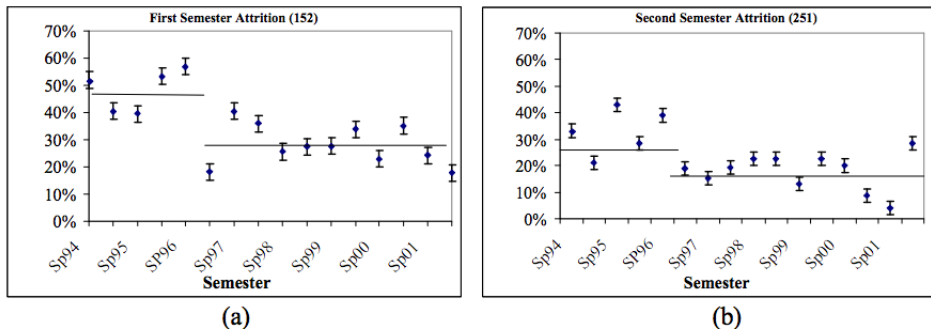


Figure 4. DWF rates for (a) introductory mechanics and (b) introductory electricity and magnetism at IUPUI.

Source: Gavrin, Watt, Marrs and Blake (2003). *Just-in-time teaching JiTT: Using the web to enhance classroom learning*. Computers in education journal, 14(2), 51-60.

DOES JITT IMPROVE LEARNING?

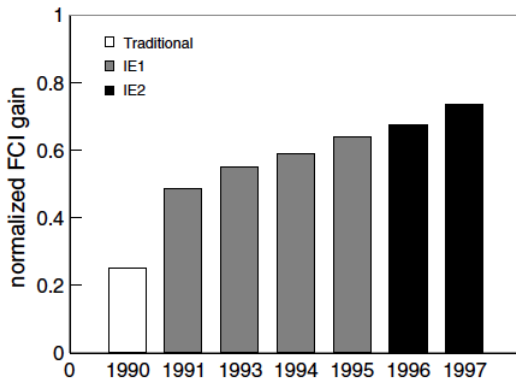


Figure 3.11. Normalized gain on the Force Concept Inventory with a traditional course (1990), IE1 courses that used PI (1991, 1993–1995), and IE2 courses that used JITT, PI, and other interactive techniques (1996–1997). From Crouch and Mazur (2001). Reprinted with permission. © American Association of Physics Teachers.

Source: Crouch and Mazur (2001), *Peer Instruction: Ten years of experience and results*, *American Journal of Physics* 69 (9),

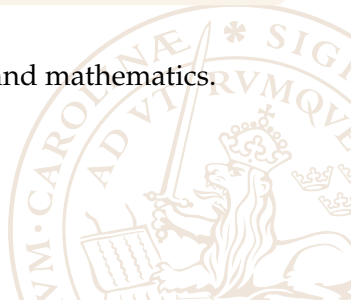
THE EXPERIMENT

Joint work with Kristina Juter, Högskolan i Kristianstad.

Our didactical research question:

- ▶ Could we make this work?

Very little has been published about JiTT and mathematics.



THE IMPLEMENTATION

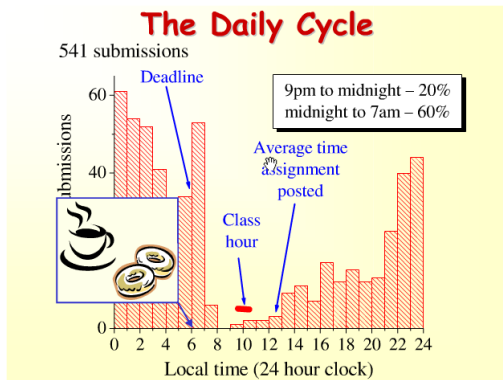
- ▶ Initial class size of 140 students.
- ▶ Randomly divided into 5 problem session groups.
 - ▶ Lecturer (me) taught one such group.
 - ▶ This was the experimental group.
 - ▶ Other four were control groups.
- ▶ Experiment lasted 2 weeks (4 sessions).
- ▶ Quiz after experiment + exam at the end.
- ▶ Students reassigned after experiment.
 - ▶ To control for “teacher” effect.



A SAMPLE RESPONSE

- ▶ Question: Explain the epsilon-delta definition of a limit in words.
- ▶ $\lim_{x \rightarrow a} f(x) = L$ as x goes towards a means that the value of the function goes toward L as x gets closer to a , but that it will never reach the exact value since the point that is exactly in a is undefined. It is so despite the fact that we can make a pretty good guess of what it is supposed to be, but it is not possible to know exactly.
- ▶ The expression describes the value, L , that the function, $f(x)$, gets closer to as x approaches the number a . The value of the functions when x is a does not have to be L or even be defined. We seek the value of the function when x gets closer to a , but not when x is a .

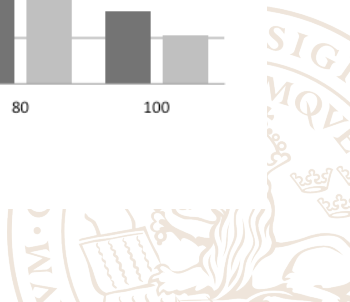
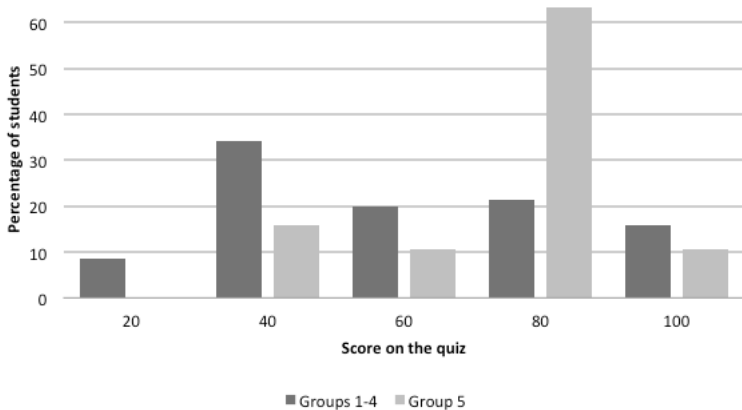
A CHALLENGE



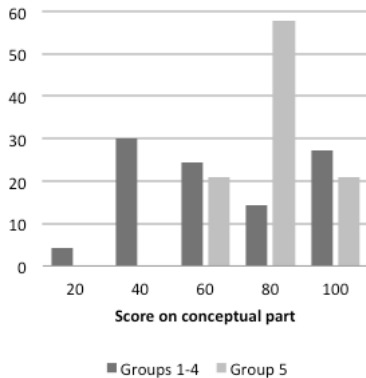
Source:

<http://www.phys.ufl.edu/~hill/talks/Cottrell%2004.pdf>

MAIN RESULT



MAIN RESULT



MORE RESULTS

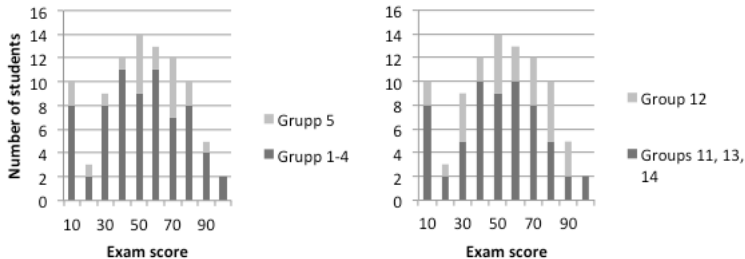
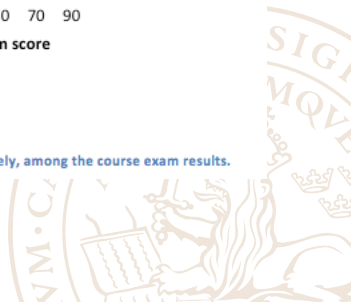


Figure 5: The distribution of the exam scores of group 5 and group 12, respectively, among the course exam results.



MORE RESULTS

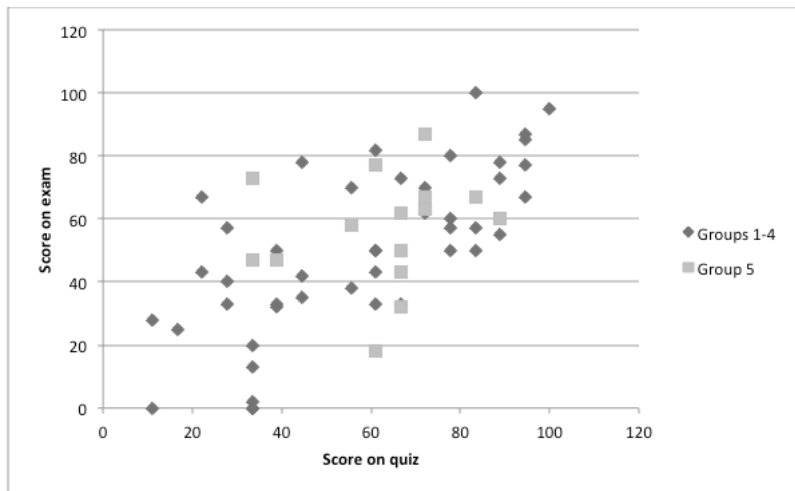
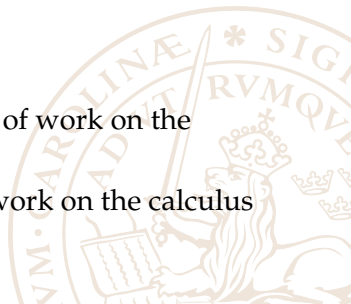


Figure 6: Scatter plot of quiz score versus exam score. If pooled together, the scatter plot yields a Pearson correlation coefficient is 0.65 which is statistically significant with a one-sided p-value of less than 0.005.

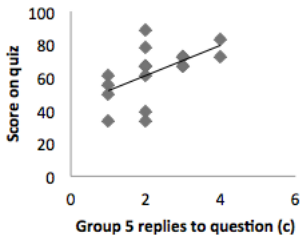
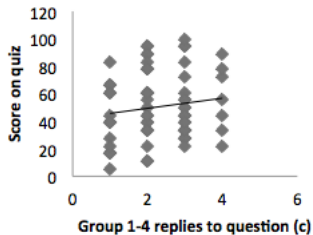
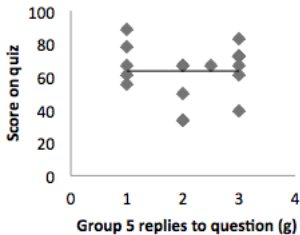
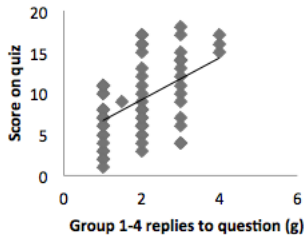
MORE RESULTS

Working habit questions:

- (a) I prepare well before problem sessions.
- (b) I prepare well before lectures.
- (c) After problem sessions, I revise what we did and work further with what I did not understand or had time to do.
- (d) After lectures, I revise what we did and work further with what I did not understand or had time to do.
- (e) I usually study with other students.
- (f) I prefer to study on my own.
- (g) I feel that I spend a sufficient amount of work on the calculus course.
- (h) I feel that time is not enough for my work on the calculus course.



MORE RESULTS



Figur 4: Scatter plots of the replies to work habit question g) "It feels as if I spend a sufficient amount of time on the course" and (c) "After problem sessions I revise what we did and work further with what I did not understand."