

# Flexible Homework: Allowing Students Self-Determination In Homework

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# Outline

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- Features
- Implementation
- Behavior
- Reactions
- Performance
- Summary
- Future Research

# Why “Flexible”?

- Students make their own decisions about homework.
  - (With some restrictions.)
- The freedoms we provide allow students to:
  - spend their time more efficiently.
  - ‘design’ their own assignments.
  - tailor the challenge level to their abilities.
  - take responsibility for their own education.
  - feel like a grownup!

# Features of “Flexible Homework”

- Choose from a pool of problems.
- Problems are split into two groups:
  - Group I – Complete solutions are posted to course website several days before due date.
  - Group II – Solutions are available only after the due date.
  - At least half of the problems submitted for an assignment must be from Group II.
- Problems are given “difficulty” ratings (A, B, C).
- Options:
  - Problem types, number to choose from, completeness of solutions, “hints”, Group III, grading scheme, etc..

# Running a FlexHW Class

- Solutions, solutions, solutions.
  - Thorough, conversational, walkthrough-type solutions.
  - More words than math.
  - Address alternate methods and common stumbling blocks.
  - Point out connections to other physics ideas or everyday experience.
- Grading can be fairly lax, but not nonexistent.
- HW should be a small, but not trivial, portion of the final course grade.
- Second time through, the workload is reduced dramatically if you re-use solutions.

# How We Assign Flexible HW

- Students turn in 10 problems from a list of 15-20.
  - At least five must be from GII.
- List is split evenly into GI and GII.
  - Groups should be similar in terms of topics, difficulties.
  - If at all possible, provide parallel problems.
- Difficulties:
  - “A” level problems are for challenging the students.
  - “B” problems are ‘regular’ problems the most students should be able to handle.
  - “C” are for warm-ups or getting a handle on new formulae.
  - Assign mostly B’s.

# Course Trials

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- Several OSU classes starting in Spring 2002.
  - Honors, non-honors.
  - Calculus-based, algebra-based.
  - Reformed lecture, traditional lecture.
  - All large enrollment intro classes. (150-250 students split into two or three lecture sections.)
  - Also, three small classes at a branch campus.
- Sources of data for evaluation:
  - Calc-based mechanics, traditional lecture. (AU 2002)
  - Honors calc-based mechanics, reformed lecture. (AU 2003)
- Both courses had required web-based surveys/reports.

# Student Behavior

- Do they just choose the easy problems?
  - They lean towards them, but only a little. From AU 03:

Difficulty	Tot. Submitted	Times Avail	Subm/Avail
A	4582	64	71.6
B	8862	92	96.3
C	4643	46	100.9

- Mean assigned problem difficulty: 3.09 ( $\pm .05$ )
  - Mean submitted problem difficulty: 3.00 ( $\pm .05$ )
- Do they just copy the solutions?
  - Sometimes, but not usually.
  - They're well aware that copying won't teach them.

# How do students choose problems?

- Tend slightly towards easier ones.
- AU 2003 students marginally preferred textbook problems (Halliday/Resnick/Walker) to Context Rich (U of MN) or Active Learning Problem Sheet (“ALPS”, Van Heuvelen / Etkina) problems.
- More likely to choose problems early on the list. This seems to be the strongest effect! Almost twice as many students chose #1 as #10.



# Students' Reactions

- They like it! (Duh.)
  - Attitudes about homework are almost uniformly positive.
  - In AU 2002, 85% of respondents ranked problems with provided solutions (i.e. Group I) as being more effective in their learning process than problems without (i.e. Group II).
  - In AU 2003, students ranked the relative helpfulness of homework, lectures, recitations, and labs when it comes to “learning of physics, performance on the exam, etc.”:

Most Helpful	%
HW	41
Lec.	34
Rec.	24
Lab	1

# Student Performance Under FlexHW

- Liking it doesn't mean it's good for them.
  - After all, students like traditional lectures!
- Getting a solid “control” class is hard, but comparing some Mechanics Baseline Tests for one course:

Year	N	HW	Raw MBT	St. Err.
2001	207	trad	16.96	0.25
2002	157	flex	18.85	0.30
2003	233	flex	18.22	0.23

- In terms of student performance, Flex HW may be better than regular homework!
- What about the effect on different levels of student?

# Achievement Levels

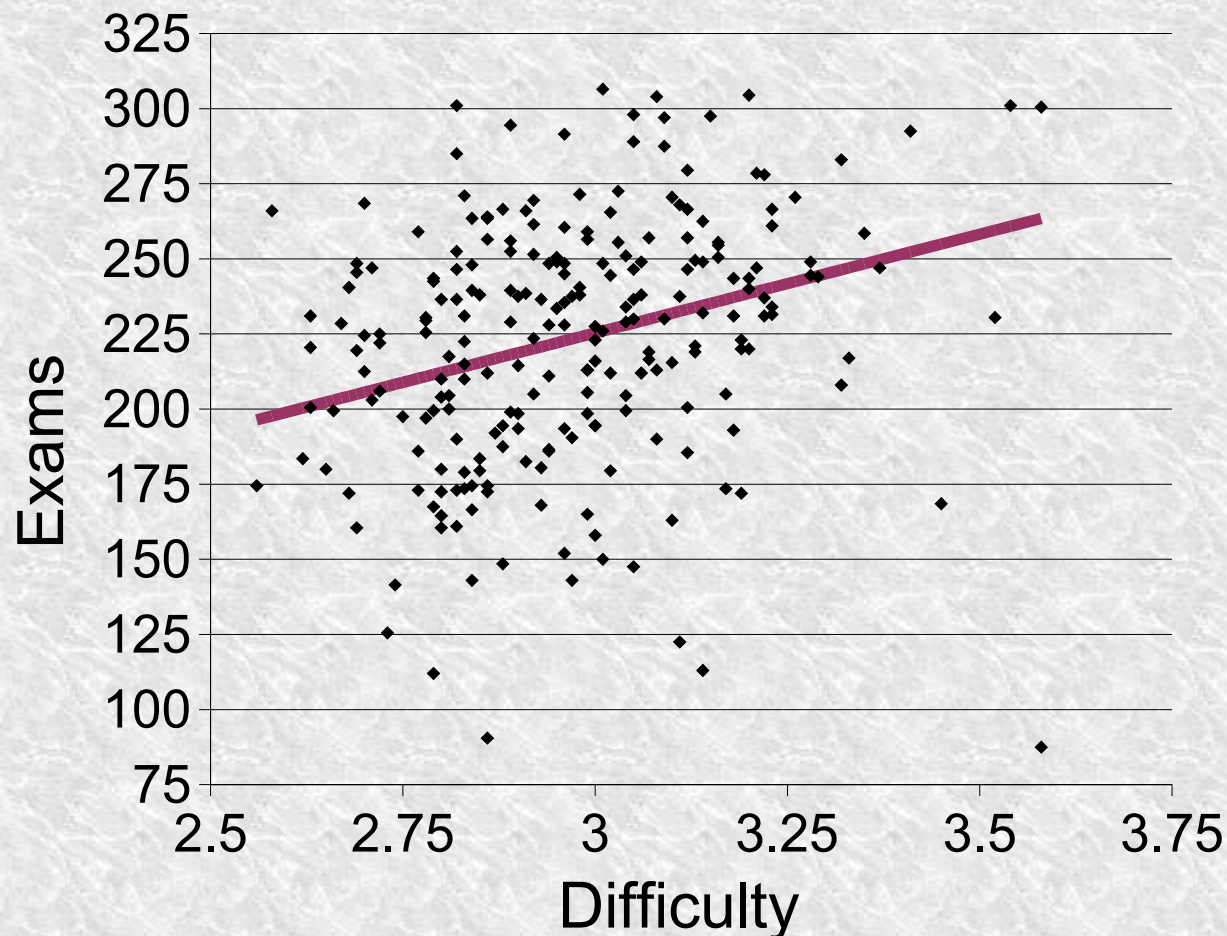
- In general, better students are spending slightly *less* time reading solutions and reading fewer of them.
- We asked AU 03 students how often they read ‘extra’ solutions and split them by exam scores (out of 350):

How often?	Ex > 250	Ex < 250
Never	34.1	19.7
A little	56.8	58.3
A lot	9.1	22.0

- One trend goes the other way:
  - correlation of exam/MBT scores with submitted HW difficulty

# Achievement and HW Difficulty

- HW difficulty and exam:  $r = 0.302$ ,  $p = .000003$
- HW difficulty and MBT:  $r = 0.228$ ,  $p = .0005$



# Summary

- Flexible HW *can* be better for the teaching staff:
  - Cursory grading is sufficient, reducing the workload.
  - The solutions – if done well – take a long time to write, but they can be reused from year to year to save time. Also, they are actually *worth* reusing.
- Flexible HW *is* better for the students:
  - Our students learn at least as much as with regular HW.
  - They strongly *prefer* the Flexible HW system. It makes them happier students.

# Future Research

- Causality of difficulty / grades relationship.
- Deeper analysis of which problems students choose and why.
- Effects of different types of provided solution.
- Wider adoption FlexHW system and/or variants?

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