

Understanding by Design



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Essential Questions

- What is “understanding” as a goal, and what does it demand of assessment and instruction?
- How can we more likely achieve understanding (and other key educational goals) by design rather than by good fortune?

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UbD is a purposeful response to the Qs:

- A **planning** framework to –
 - Keep constantly focused on outcomes, not inputs: student use and grasp of content, not content ‘coverage’
 - Keep long-term goals in view in short-term instruction & assessment
 - Better engage learners

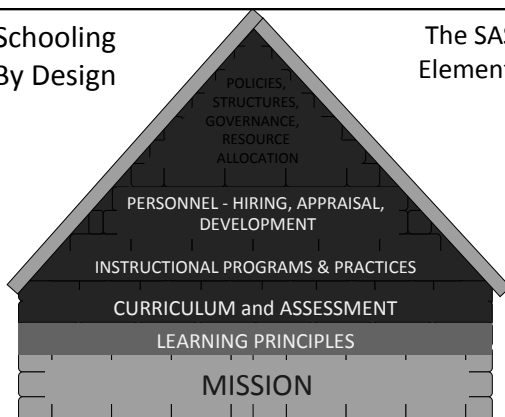
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Schooling
By Design

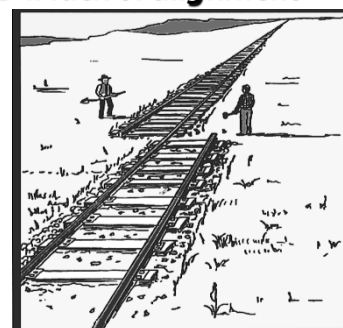
The SAS
Elements



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In short: UbD if lack of alignment

- Between –
 - Desired and actual results
 - Short-term plans and long-term goals



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The 3 big ideas

The point of education is **effective understanding**,
not prompted recall of content

Understanding = using content effectively
for **transfer & meaning**

'Backward' Design: from engaging work
and competent understanding, not 'coverage'

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Idea #1

The point of education is **effective understanding**,
not prompted recall of content

Understanding = using content effectively
for **transfer & meaning**

'Backward' Design: from engaging work
and effective understanding, not 'coverage'

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How would you complete this sentence?

- By the end of the course/program,
learners should be (better) able, on
their own, to effectively use all the
content learned, to...

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i.e. Content is a 'tool'...



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For what valued abilities?



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The big ideas - #2

The point of education is **effective understanding**,
not prompted recall of content

Understanding = using content effectively
for **transfer & meaning**

'Backward' Design: from engaging work
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What is real understanding?
How does it differ from 'knows a lot'?

□If you really understand you can...	□If you know a lot, but don't really understand, you can only...

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Group the answers

□If you **Figure Out** understand you can...

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Formal language

□If you *really* understand you can...

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What is real understanding?
(Harvard Science Profs & Grad Stdts)

□If you really understand you can...	□If you know a lot, but don't really understand, you can only...
<ul style="list-style-type: none"> • Apply what you've learned new context • You can prove something • You can distinguish normal from abnormal results • Design a solution to your problem • Have a fruitful intuition • Effectively teach it e.g. good analogies • Consistently good performance 	<ul style="list-style-type: none"> • You can perform the steps but not explain why or why better/worse • Plug in, can't adapt • Don't know where your limits are – (Socrates)

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Essence of Backward Design:

S1: Goal
S2: IF goal, THEN: evidence?
S3: IF goal & evidence, THEN... learning?

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Essence of Backward Design:

S1: Goal: Understanding, i.e. all the things you just said
S2: IF...THEN... If that's the goal, what follows for assessment?
S3: IF...THEN... If that's the goal and evidence needed, what follows for appropriate learning activities?

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Some assessment Implications

- ▣ Can't over-rely on multiple-choice: they cannot get at use or complex meaning-making
- ▣ More oral assessment and/or online feedback/adjustment needed
- ▣ Increasingly novel challenges in varied contexts

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Some Instructional Implications

- ▣ Students confront puzzling texts/ data/situations
- ▣ Many opportunities to practice, get feedback, use it in attempts to transfer...
- ▣ Lectures a minority of the time; more case study, PBL, seminars, labs

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Some Instructional Implications

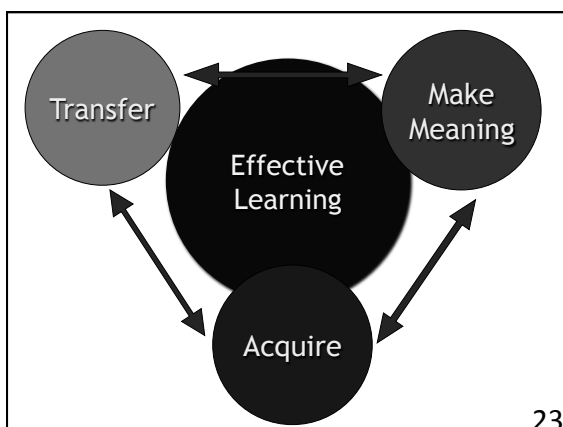
- ▣ Lectures a minority of the time; more interactive work, even in large groups
 - *Washington Post* [article on undoing of lectures at MIT, Johns Hopkins, etc.](http://www.washingtonpost.com/local/education/colleges-looking-beyond-the-lecture/2012/02/03/gIQA7iUaGR_story.html)
 - http://www.washingtonpost.com/local/education/colleges-looking-beyond-the-lecture/2012/02/03/gIQA7iUaGR_story.html
 - Eric Mazur of Harvard video on Youtube
 - <http://www.youtube.com/watch?v=WwslBPj8GgI>

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Some Instructional Implications

- ▣ The rethinking of pedagogy
 - *Clinical education in law and the broader disconnect between legal education and law practice.*
 - The swift and dramatic overhaul of medical education in the last 30 years to PBL

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Acquire ***Acquisition goals***

- ▣ Learn, with accurate and timely recall, important facts and discrete skills
- ▣ AIM: automaticity of recall, when needed in performance

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Make
Meaning

Meaning goals

- **Make connections & generalizations, using the facts and skills –**
 - e.g. interpret, gist, main idea, thesis, empathize, critique, etc.
- **AIM: independent and defensible student inferences about situations, texts – ‘helpful and insightful understandings’**

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Transfer

Transfer Goals

- **Adapt your knowledge, skill, and understanding to specific and realistic situations and contexts**
- **AIM: efficient, effective solutions for real-world challenges, audiences, purposes, settings**

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Not a new idea: Bloom -

- "Application is different from simple comprehension: the student is not prompted to give specific knowledge, nor is the problem old-hat. The tests must involve situations *to the student...*
- "Ideally we are seeking a problem which will test the extent to which the individual has *learned to apply an abstraction in a practical way.*"

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TMA Questions

T: What do you want them to be able to do with content on their own in the future?

M: What kind of thinking do you want them to do and what kinds of understandings do you want them to grasp or validate?

A: What knowledge and skills are needed to achieve these longer-term goals?

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TMA in Physics

T: Maximize the distance or trajectory accuracy of an object (e.g. CO₂ car, roller coaster, catapulted object, missile, baseball, etc.) using the laws of physics

M: Correctly interpret & model the acting forces in any situation

A: Acquire concept & skills of analysis of force

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TMA in Business

T: Successfully market & sell a new product, and optimize profit

M: Correctly interpret the needs, wants of customers and price point data

A: Acquire concept & skills of marketing, sales, and pricing

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TMA in Geography

T: Make and navigate via maps (region, era, unusual features, etc.)
M: Make sense of varied and newly-encountered maps, old and new; and explain what they reveal
A: Acquire skills of making and reading maps

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TMA in math

T: analyze, graph, and solve non-routine and unfamiliar problems in varying contexts, on one's own, in which it is unclear which math applies, whether there is error in the data, and how to model the data.
M: Correctly interpret the meaning of data patterns or line of 'best fit' of data points
A: Acquire knowledge of functions & skills of plotting point pairs, accurately drawing the graph of a line from a linear equation, etc.

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Thus, the course is not the textbook

- The textbook is a resource
 - It is jam-packed, to be sold in 50 states!
 - Like an encyclopedia & dictionary, it provides topically organized content
- No text can cause transfer, and most texts mistakenly treat meaning-making as acquisition of the "meaning" the authors give.

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THUS: Prioritize use of textbooks

- Given our understanding goals, which chapters should be –
 - highlighted?
 - skimmed?
 - skipped?
 - Re-sequenced?
- What assessments are needed, beyond what the textbook has?

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Try again: aim for explicit understanding

- I want students to understand –
 - The Constitution
 - The 3 branches of government

No - not a goal - this just says what the content is

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Backward from Goals: Transfer

- "I want students to leave able to transfer their understanding – on their own – to concretely address current and future situations:
 - Design a school government
 - Design a government for Iraq
 - Organize their workplace
 - Support candidates who understand our core principles

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Backward from Goals: Meaning

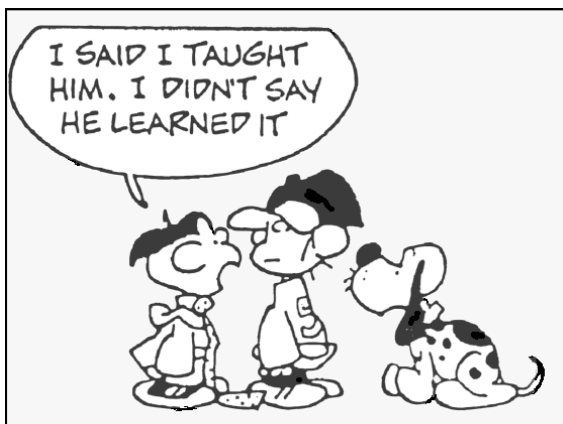
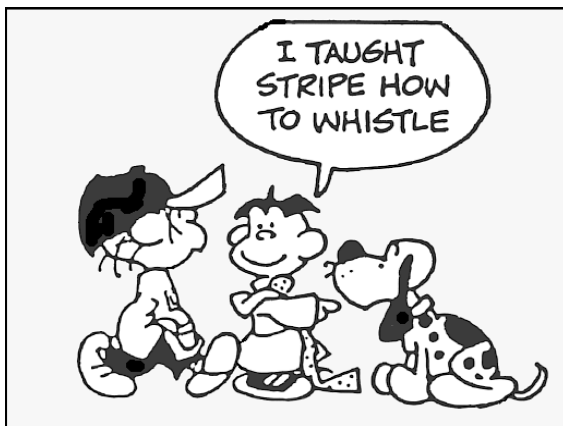
- “I want students to leave having inferred/ realized that, now & in the future –
 - The Constitution is a solution, based on compromise, to real problems of balance and limit of powers
 - The compromise has a long, sometimes bitter history – with many fights that are with us and will always be with us.

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However...

- It doesn't matter whether or not you say it well and clearly.
- What matters is whether students, on their own, can use what you say in the ways we described 'understanding' above

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An example of unit design: math

- What is fair? How can math help (or not)?
 - When we say something is 'fair' or 'unfair' what do we mean? How 'mathematical' should our evidence be?
 - Students generate, categorize examples of "That's fair!" and "That's not fair!"

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"What is Fair? Can math help?"

Problem - Four 7th-grade classes had a race of all the students.

IN GROUPS: Devise at least 2 different ways to determine a fair ranking of the classes, given the results.

Then, agree on the most fair way, and be prepared to defend your answer...

Class rank	Class A	Class B	Class C	Class D
1	4	6	1	2
2	9	7	3	5
3	11	10	14	8
4	12	13	18	15
5	20	16	19	17
6	21	22	23	31
7	25	24	28	33
8	26	27	30	36
9	29	34	32	37
10	35	39	41	38
11	43	40	44	46
12	45	42	47	51
13	49	48	50	55
14	54	52	56	57
15	61	53	60	58
16	65	62	63	59
17	69	66	64	67
18	70	72	*	68
19	71	*	*	73
20	*	*	*	74

Individual ranking of runners in a race by all 7th-grade classes

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Next: further discussions

□ Jigsaw on fairness

- What do we mean when we say that the rules of a game of chance are "not fair"? What role does math play in our judgment?
- Why is it fair to have one person cut the cake and the other person to choose the piece?
- When is straight majority voting "fair" and when is it "not fair"?
- When is it "fair" to consider an "average" in ranking performance (e.g. salaries, home prices, batting average) and when is it "unfair"?

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The content is learned - "just in time"

□ "Guys, mathematicians have a few tools that might help us..."

- Lessons on measures of central tendency:
 - Mean
 - Median
 - Mode
- Quizzes to check for skill

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Final assessment tasks

□ Propose and defend a "fair" grading system for use in this class.

- How should everyone's grade be calculated? Why is your system more fair than the current system (or: why is the current system most fair?)

□ A final reflection on the question: What is fair and what isn't fair?

- When should you and shouldn't you use mean, median, mode?

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In short, if you have effective understanding, you are able to –

- Efficiently and effectively make sense of things and use the most appropriate content, in context, successfully.

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The deeper and more disturbing issue

- The job is not to 'teach' but to 'cause as much learning as possible' – by 'design'

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The big ideas - #3

The point of education is effective understanding,
not prompted recall of content

Understanding = using content for
transfer & meaning

'Backward' Design: from engaging work
and competent understanding, not 'coverage'

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Essence of Backward Design:

S1: Students should leave [transfer,
meaning, acquisition goals]

S2: So, we need evidence of [transfer,
meaning acquisition]

S3: So, they will need to learn and
learn how to [transfer, meaning,
acquisition]

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What we typically (incorrectly) do:

Identify the topics and content to be covered

Determine how you will teach the content

When grades are due, assess
the learning of the content

Do you see why this is an error?

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KEY: 3 Stages of ([“]Backward[”]) Design

Stage 1: Identify goals – the uses of content
(T) and meaning-making (M) sought, and the
enabling skill & knowledge (A) needed

Stage 2: Determine the most appropriate
assessment evidence of STAGE 1 TMA Goals

Stage 3: Determine the most appropriate learning
activities and instruction, given the goals (ST1)
and evidence (ST2)

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Consider:

□ The game



□ The drills



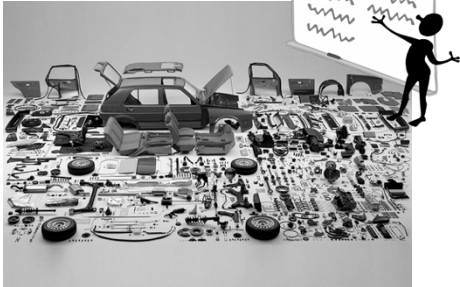
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Consider: goal of Driver's Ed – even with limited time



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Hint: not a good way to learn to drive...



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Backward Design: clarify assessments first!

Stage 1: Identify goals – the uses of content and meaning-making sought, and the enabling skill & knowledge needed

Stage 2: Determine the most appropriate assessment evidence of STAGE 1 Goals

Stage 3: Determine the most appropriate learning activities and instruction, given the goals (ST1) and evidence (ST2)

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Think like a judge 

- Is the evidence appropriate?
- Is the evidence convincing?
- Is there enough evidence, of different kinds to establish competence 'beyond a reasonable doubt'?

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Questions for TESTING the validity of assessments

- Could the proposed 'test' be done well - without STAGE 1 being accomplished or furthered?
- Could the specific test result be poor, but it be plausible that the student might still really have achieved STAGE 1 satisfactorily?
- The proposed assessment is valid only if you can answer NO to both

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Tip: Infer Goals from the Assessments

Standard(s):

STAGE 1: Desired Results

Cover Stage 1

What do the assessments suggest the goals must be?

STAGE 2: Assessment Evidence

STAGE 3: Learning Plan

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Backward Design: the activities have to yield successful performance

Stage 1: Identify goals – the uses of content and meaning-making sought, and the enabling skill & knowledge needed

Stage 2: Determine the most appropriate assessment evidence of STAGE 1 Goals

Stage 3: Determine the most appropriate learning activities and instruction, given the TMA goals (ST1) and evidence (ST2)

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What's the best use of precious class time?

- What can only or best be done in class together?
- What is the most engaging and thought-provoking way to use class time?
- What can't be found for free on the Internet?

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To put it bluntly:

- In a world of books, Google, GoogleDocs, wikis, and YouTube, why are you wasting precious class time on the delivery of information?

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Transfer + Meaning - independently learning

- I do, you listen & watch
- I do, you help
- You do, I help
- You do, I listen & watch
 - The 'gradual release' model is a general schema for the development of independent mastery at any age, in any subject

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Bain's study of the best college teachers

- "We studied more than 60 professors from various disciplines to try to determine what outstanding teachers do inside and outside their classrooms that might explain their accomplishments.
- And when we examined in particular how good teachers conduct class, we found that they follow several common principles...."

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Bain's research

- They create a natural critical learning environment.
 - "Natural" because what matters most is for students to tackle questions and tasks that they naturally find of interest, make decisions, defend their choices, sometimes come up short, receive feedback on their efforts, and try again.

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Bain's research

- They create a natural critical learning environment.
 - "Critical" because by thinking critically, students learn to reason from evidence and to examine the quality of their reasoning, to make improvements while thinking, and to ask probing and insightful questions.

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Bain's study of the best college teachers

- "The second important element is guidance in helping students understand the significance of the question."

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Bain's research

- "In all the examples, students encounter safe yet challenging conditions in which they can try, fail, receive feedback, and try again before facing a summary evaluation."

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What research says on teaching for transfer

- "The single most important variable in promoting long-term retention and transfer is "practice at retrieval."
 - This principle means that learners need to generate responses, with minimal cues, repeatedly over time with varied applications so that recall becomes fluent and is more likely to occur across different contexts and content domains.
 - Simply stated, information that is frequently retrieved becomes more retrievable."

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Research on transfer:

- "An especially sensitive way to assess the degree to which students' learning has prepared them for transfer is to use methods such as "graduated prompting". This method can be used to assess the amount of help needed for transfer by counting the number and types of prompts that are necessary before students are able to transfer.
- Some learners can transfer after receiving a general prompt such as "Can you think of something you did earlier that might be relevant?" Other learners need prompts that are much more specific. Tests of transfer that use graduated prompting provide more fine-grained analysis of learning and its effects on transfer than simple one-shot assessments.

• From *How People Learn*

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Harvard Self-Study: most effective courses

- "The big point—it comes up over and over again as crucial—is the importance of quick and detailed feedback. Students overwhelmingly report that the single most important ingredient for making a course effective is getting rapid response on assignments and quizzes."
- "Students suggest that it should be possible in courses to get immediate feedback. They suggest that the professor should always hand out examples of excellent and not excellent answers."

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Harvard Study (2)

- "Secondly... an overwhelming majority are convinced that their best learning takes place when they have a chance to submit an early version of their work, get detailed feedback and criticism, and then hand in a final revised version..."
- "Many students observe that their most memorable learning experiences have come from courses where such opportunities are routine policy."

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Eric Mazur's 10 years of research at Harvard in Physics

□After 10 minutes, Mazur poses a question that requires conceptual understanding (such as estimating the displacement of a toy boat in a bathtub).

- Students write their answers on a sheet and identify their levels of confidence in the answer.
- In pairs, attempt to convince others of their answers.
- Students then answer the question a second time and report their confidence levels again.
- The whole class is polled again about their answers.

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Mazur

□Mazur has collected data on the impact of his approach on several outcome measures over a decade vs. traditional lecture -

- students performed considerably better on standard physics course exams
- students scored higher on measures of traditional problem solving
- Students scored much higher in conceptual understanding

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Mazur

□Mazur: "No lecturer, however engaging and lucid, can achieve this level of improvement and participation simply by speaking."

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Engaging students by design: "Most Interesting Work"

- Researching a person who had a drug or alcoholic problem in health and was just interesting learning all about the addiction and how it takes over the person.
- An essay about Huck Finn being a racist novel. It was interesting because I had to argue a point I didn't believe in.
- Making a kids' book in health. This was most interesting because I was able to understand how people relate to younger children to get a message across.

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Most Interesting Work

- In my sociology class we did a study where we went to all of the lunches and just sat with different groups of people and study group behavior. Then we mapped out the whole lunch room with where different groups typically sat. It was interesting because I got to go out of my comfort zone and study people..
- Last year, in art, the most interesting piece I did was an eye project. We had to choose four different artists styles and paint one eye for each style. It presented a challenge but it was fun.

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Most Interesting Work

- A journal that we had to keep in History class. We had to write a story about what it would be like if we were a certain character during the French Revolution, and we had certain topics to write about with each entry. There were 6 entries.

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Most Interesting Work

- Last year in my Spanish class we were asked to make a movie trailer in Spanish, and our group was extremely engaged in the task. Most likely because we enjoyed filming our project using our own script. We were allowed to expand our ideas and present them.
- An interesting project we did was in Geometry. It was the centroid/circumcenter project where we had to set up a company and consider its ideal headquarters location using geometry & algebra.

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for further information...

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