Educating the innovators of the 21st century

The University of Hong Kong
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Innovation
Nobel Prize in Physics 2010
Nobel Prize in Physics 2010

Ig Nobel Prize in 2000
Nobel Prize in Physics 2010

Ig Nobel Prize in 2000
“For me it’s very boring to work on the same thing year after year…”
“For me it’s very boring to work on the same thing year after year…”

graphene resulted from

“Friday night experiments where you try something very elementary and try to go in another direction”
how can we foster/teach innovation?
Need to…

• teach *problem* solving

• encourage risk taking
education
1 education  
2 PI  
3 test
What happens in a lecture?
education
some people talk in their sleep
some people talk in their sleep
lecturers talk while other people are sleeping

(Albert Camus)
education
The result?
Lack of learning
Lack of learning
Lack of retention
not transfer but assimilation of information is key
assessment promotes memorization and stifles creativity
problem
problem

outcome
problem  solution  outcome

EDUCACION
1 education

problem solution unknown

problem procedure known

outcome answer known
problem solution outcome

problem procedure answer
computers can do this!
REAL

problem solving
problem

approach 1

approach 3

approach 2

outcome

education
assessment incompatible with real problem solving
Traditional assessment

• focuses on outcome, not process
Traditional assessment

• focuses on outcome, not process
• discourages risk taking
Traditional assessment

• focuses on outcome, not process
• discourages risk taking
• focuses on individual, not group
Traditional assessment

- focuses on outcome, not process
- discourages risk taking
- focuses on individual, not group
- does not mirror future work environment
1 education
2 PI
1. transfer of information
1. transfer of information

2. assimilation of that information
1. transfer of information (in class)

2. assimilation of that information
1. transfer of information (in class)

2. assimilation of that information (out of class)
1. transfer of information (in class)

2. assimilation of that information (out of class)

Should focus on THIS!
1. transfer of information (in class)

2. assimilation of that information (out of class)
1. transfer of information (out of class)

2. assimilation of that information (in class)
1. transfer of information (out of class)

2. assimilation of that information (in class)
question
question

think
question
think
poll
discuss
1. education

2. PI

- question
- think
- poll
- discuss
- repoll
- explain
question

think

poll

discuss

repoll

explain
Let’s try it!
thermal expansion
all of them
all of them
Consider a rectangular metal plate with a circular hole in it.
Consider a rectangular metal plate with a circular hole in it.

When the plate is uniformly heated, the diameter of the hole

1. increases.
2. stays the same.
3. decreases.
Consider a rectangular metal plate with a circular hole in it.

When the plate is uniformly heated, the diameter of the hole

1. increases
2. stay the same
3. decreases.
Consider a rectangular metal plate with a circular hole in it.

When the plate is uniformly heated, the diameter of the hole

1. increases.
2. stays the same.
3. decreases.
Before I tell you the answer…
Before I tell you the answer, let’s analyze what happened.
Before I tell you the answer, let’s analyze what happened.

You...

1. made a commitment
Before I tell you the answer, let’s analyze what happened.

You…

1. made a commitment
2. externalized your answer
Before I tell you the answer, let’s analyze what happened.

You…

1. made a commitment
2. externalized your answer
3. moved from the answer/fact to reasoning
Before I tell you the answer, let’s analyze what happened.

You...

1. made a commitment
2. externalized your answer
3. moved from the answer/fact to reasoning
4. became emotionally invested in the learning process
Consider a rectangular metal plate with a circular hole in it.

When the plate is uniformly heated, the diameter of the hole

1. increases.
2. stays the same.
3. decreases.
Consider a rectangular metal plate with a circular hole in it.

When the plate is uniformly heated, the diameter of the hole

1. increases. ✔
2. stays the same.
3. decreases.
consider atoms at rim of hole
consider atoms at rim of hole
consider atoms at rim of hole
consider atoms at rim of hole
consider atoms at rim of hole

you won't forget this
Higher learning gains

1 education
2 PI
3 test
Peer instruction

Higher learning gains

Better retention
in a lecture, students...
in a lecture, students...

1. don’t pay utmost attention
in a lecture, students...

1. don’t pay utmost attention

2. think they know it
in a lecture, students...

1. don’t pay utmost attention
2. think they know it
3. are not confronted with misconceptions
in a lecture, students...

1. don’t pay utmost attention
2. think they know it
3. are not confronted with misconceptions
an illusion...
Education is not just about:

- transferring information
- getting students to do what we do
Education is not just about:

• transferring information
• getting students to do what we do

active participation a must!
With a simple change, Peer Instruction...

• teaches *real* problem solving

• encourages risk taking
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