


Clicking Basic College Mathematics and Beyond

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Clicking Basic College Mathematics *and Beyond*

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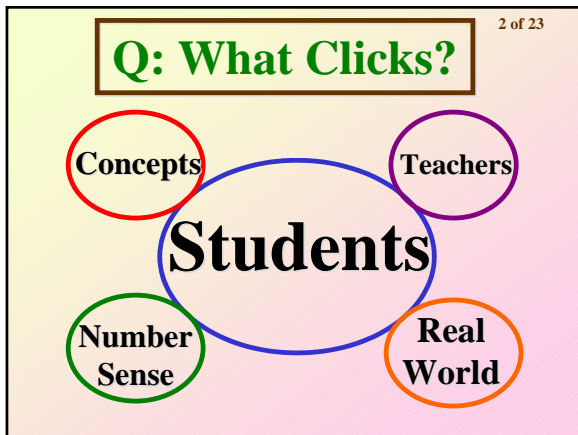


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Boston, MA November 13th, 2010

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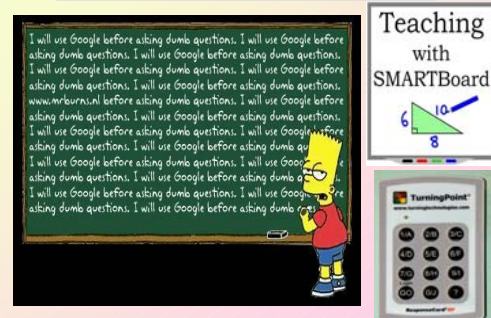
A: Net Generation in

Basic College Math (BCM),
Beginning Algebra,
Intermediate Algebra,
and Pre-Calculus classes
& the instructors!



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Teaching Tools



Teaching with SMARTBoard

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Q: Who Clicks?



"No, you weren't downloaded.
You were born."

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Clicker Technology

(Software included as an add-on to PowerPoint)



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CQ#: Have you heard about Clicker Teaching Technique (CT²)?

1. Yes
2. No

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

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What if ... ?

... the correct-response percentage is **below 30**

- Spend **more** time
- Review the example
- Mix in Peer-Instruction

✓ **Re-Poll**

“There is an old saying in Tennessee ... Fool me once, shame on you; the fool can't be fooled again!”

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What is Clicker Teaching Technique (CT²)?

- ❖ After each concept or skill is lectured, Clicker Questions (CQs) in the form of multiple-choice are **given, discussed, and solved** with **more or less** explanations.
- ❖ Different amount of time is required on each CQ according to the **30 ~ 70 rule***.

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Lesson #: Multiplying Fractions

To multiply two fractions, we

multiply the numerators and **multiply the denominators**

NEVER cross-multiply!

$$\frac{3}{7} \times \frac{2}{5} = \frac{6}{35} \quad \begin{matrix} \leftrightarrow 3 \times 2 = 6 \\ \leftrightarrow 7 \times 5 = 35 \end{matrix}$$

In general, for all positive whole numbers $a, b, c,$ and $d,$

$$\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d}$$

(when b and d are not 0).

DO multiply-across!

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What if ... ?

... the correct-response percentage is **above 70**

- Most students **got it!**
- Spend **less** (or no) time to review CQs
- ❑ **Correct** any common misconception.

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CQ1. Multiply.

$$\frac{5}{7} \times \frac{3}{8}$$

1.. $\frac{15}{56}$

2.. $\frac{21}{40}$

3.. $\frac{8}{15}$

4.. $\frac{40}{21}$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
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Lesson #: Exponent Rules

The Product Rule: To multiply two exponential expressions that have the same base, **keep the base** and **add the exponents**.

$$x^a \cdot x^b = x^{a+b}$$

Example:
Multiply. a.) $c^4 \cdot c^5 = c^{4+5} = c^9$
b.) $3a^3 \cdot a^6 = 3a^{3+6} = 3a^9$
c.) $4w^2 \cdot 2w^5 = (4)(2)w^{2+5} = 8w^7$

Numerical coefficient

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What if ... ?

... the percentage is exactly the same

1	2	3	4
25%	25%	25%	25%

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CQ2. Multiply. Leave the answer in exponent form.

1.. 2^{15} $2^5 \cdot 2^3$

2.. 4^{15}

3.. 4^8

✓ 4.. 2^8

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

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What are the *advantages* of CT^2?

- Take attendance
- Obtain **instant feedback** on skills just taught in order to control the pace of lectures
- Walk around to provide **one-to-one tutoring** while students are working on the CQ
- **Engage students in active/deep learning!**

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What if ... ?

... the correct-response percentage is **between 30 and 70**

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Clicker Survey in BCM (Fall 2009 & Spring 2010) [Sample size = 113 (9 sections)]

1. Participation with clickers **improved my feeling of belonging** in this course.
Strongly Agree or Agree → 83%
Strongly Disagree or Disagree → 6%
2. Participation with clickers **improved my understanding of the subject content**.
Strongly Agree or Agree → 85%
Strongly Disagree or Disagree → 5%

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What are the *disadvantages* of CT²?

- ❖ Computer system may be *slow* or *unstable*!
- ❖ **Cost** (approx. \$40 per clicker)

❖ **Preparation time**
for PowerPoint lecture notes **PLUS**
developing **good** (or better) **CQs!!!**

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Future CQ Projects

[College-level Courses]

Elementary Statistics
(Algebra-based)

Intermediate Algebra

Pre-Calculus

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Past/Ongoing Projects

- Cornell (NSF: Project GoodQuestions) [[Calculus](#)]
- Carroll (NSF: Projects MathQUEST & **MathVote**) [[Differential Equations](#) & [Linear Algebra](#)]

How about developmental math courses in 2-year colleges?

We need more people to work on this!

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More Info about CT²

- ❖ **Dr. Derek Bruff** (Vanderbilt University)
<http://derekbruff.com/teachingwithers/>
- ❖ **Dr. Eric Mazur** (Harvard University)
<http://mazur-www.harvard.edu/>
- <http://www.math.cornell.edu/~GoodQuestions/>
- <http://mathquest.carroll.edu/>

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Funding?

- **Next Generation Learning Challenges (NGLC) grant by the Bill & Melinda Gates Foundation?**
Due: Nov. 19th, 2010
- **Course Curriculum and Laboratory Improvement (CCLI) Program of NSF?**