Evaluating Videos for Flipped Instruction

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● Introductions
● Overview of our Study
● Flipped Classroom Framework
● Videos Examples
● Discussion
● Q&A
Introductions

Introduce yourself to your neighbor and then discuss the following questions:

- Have you ever made or assigned videos for homework (as in flipped classes)?
- When you think of videos in flipped classes, what comes to mind?
Our Study - FlippedMathStudy.net

- Why study flipped mathematics?
- Scope of the study
Framework

At Home

- Video/Multimedia
  - Lecture
    ⇒ Multimedia Design
    ⇒ Mathematical Quality
    ⇒ Interactivity
  - Set-Up or Motivation
    ⇒ Connection (explicit, implicit, or not discernible) to Learning
- Problems/Exercises
- No Homework

In Class

- Whole-Class Format
  - Univocal Discourse
    ⇒ Mathematical idea
    ⇒ Mathematical justification
    ⇒ Attention to receivers
    ⇒ Other features (motivation, connections)
  - Dialogic Discourse
    ⇒ Mathematical question/goal
    ⇒ Mathematical justification
    ⇒ Other features
- Non-Whole-Class Format
  - Groups
    ⇒ High Cognitive Demand
    ⇒ Low Cognitive Demand
  - Independent (Voluntary Grps.)
    ⇒ High Cognitive Demand
    ⇒ Low Cognitive Demand

Factors mediating at-home influence on in-class

Availability of resources, Student behaviors (e.g., watching or not watching, pausing or skipping ahead), Teacher and Parental Expectations, Accountability, etc.

Factors mediating in-class influence on student outcomes

Teacher expectations, Student behaviors, Norms, Time, Resources, Physical arrangement, etc.

Student Outcomes

Students' Knowledge, Skills, and Other Outcomes
Framework

At Home
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Video/Multimedia

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Problems/Exercises

No Homework
At Home

Video/Multimedia
- Lecture
- Multimedia Design
- Mathematical Quality
- Interactivity

Set-Up or Motivation
- Connection (explicit, implicit, or not discernible) to Learning

Problems/Exercises

No Homework
## Framework - Lecture Videos

<table>
<thead>
<tr>
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</tr>
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<tbody>
<tr>
<td>● Richness and development of the mathematics</td>
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Framework

Mathematical Quality

- Richness and development of the mathematics
- Precise language
- No unmitigated mathematical errors

LESSONS 4-2: RELATIONS & FUNCTIONS

GUIDING QUESTIONS:
1. What determines a function?
2. What are the different ways you represent a function? Which do you prefer?
3. How does the vertical line test help determine whether a graph is a function or not?

ENGAGE:
Functions can be represented many ways. A function is a relation where every input has exactly ONE output. Look at each representation on this page and determine if it IS or IS NOT a function. Tap on the red check mark next to it to reveal the answer.

The graph DOES NOT pass the Vertical Line Test.

NO, this IS NOT a function.
Framework

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Use “dancing at a ball” to describe the structure of a function. “For every one person, you can only dance with one more person at the dance. If you decided to dance with two people, it is not going to be pretty by the end of the night.”

---- Quote from our MTMS paper
## Framework

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Multimedia Design

- Multimedia principle
- Contiguity principle
- Redundancy principle
- Modality principle
- Coherence principle
- Personalization principle
Framework

Multimedia Design

- Multimedia principle
- Contiguity principle
- Redundancy principle
- Modality principle
- Coherence principle
- Personalization principle

Multimedia principle: judiciously select and add graphics to text (there are some relevant graphics or animations included, so a complete absence of graphics would be coded as “does not adhere”)

### LESSONS 4-2: RELATIONS & FUNCTIONS

**GUIDING QUESTIONS:**
1. What determines a function?
2. What are the different ways you represent a function? Which do you prefer?
3. How does the vertical line test help determine whether a graph is a function or not?

**ENGAGE:**
Functions can be represented many ways. A function is a relation where every input has exactly ONE output. Look at each representation on this page and determine if it IS or IS NOT a function. Tap on the red check mark next to it to reveal the answer.

<table>
<thead>
<tr>
<th>Time (hr)</th>
<th>Water Level (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>20</td>
</tr>
</tbody>
</table>

**Number of Hours**

<table>
<thead>
<tr>
<th>Number of Hours</th>
<th>0</th>
<th>3</th>
<th>5</th>
<th>8</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>1</td>
</tr>
<tr>
<td>-1</td>
<td>2</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
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(NO, this IS NOT a function. The graph DOES NOT pass the Vertical Line Test.)

<table>
<thead>
<tr>
<th>$x$</th>
<th>$f(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>5</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>-2</td>
<td>11</td>
</tr>
<tr>
<td>-3</td>
<td>14</td>
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Framework

Multimedia Design

- Multimedia principle
- **Contiguity principle**
- Redundancy principle
- Modality principle
- Coherence principle
- Personalization principle

Contiguity principle: place relevant text near graphics (textual and graphic elements are placed near each other when appropriate)
Framework

Multimedia Design
- Multimedia principle
- Contiguity principle
- **Redundancy principle**
- Modality principle
- Coherence principle
- Personalization principle

**Redundancy principle**: do not include audio that simply reads aloud written text (this would be “does not adhere” if it were relatively large blocks of text that were read aloud, but of course words or short phrases are allowed to appear multi-modally)
Modality principle: explain graphics with audio (the narrator or the text points out important features of the graphics -- it would be a problem if there are important graphics that are not unpacked or interpreted)
Framework

Multimedia Design

- Multimedia principle
- Contiguity principle
- Redundancy principle
- Modality principle
- **Coherence principle**
- Personalization principle

**Coherence principle:** use only pertinent graphics and audio ("does not adhere" would be videos where the graphics become cluttered or has irrelevant things included)
Framework

“As I move [the vertical line], uh oh, look what happens!”
--quote from Ms. Temple’s iBook

### Multimedia Design

- Multimedia principle
- Contiguity principle
- Redundancy principle
- Modality principle
- Coherence principle
- **Personalization principle**

**Personalization principle**: use a conversational tone when possible (audio that is extremely formal or sounds like someone stiffly reading from pre-written text would be coded as “does not adhere”)}
Framework

Interactivity

- Virtual manipulatives
- Digital interactive features (e.g., embedded questions)
- Dynamic representations of mathematical concepts
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WHAT IS A FUNCTION?
Video #2

Area between curves

\[
\int_0^1 \sqrt{x} \, dx - \int_0^1 x^3 \, dx
\]

\[
\int_0^1 (\sqrt{x} - x^3) \, dx
\]

\[
= \left[ \frac{2}{3} x^{3/2} - \frac{x^4}{4} \right]_0^1
\]

\[
= \frac{2}{3} - \frac{1}{4} = \frac{3}{12} - \frac{3}{12} - \frac{1}{12}
\]

\[
= \frac{3}{12} - \frac{4}{12} = \frac{3 - 4}{12} = \frac{-1}{12}
\]
## Framework - Set Up/Motivation Videos

<table>
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<tbody>
<tr>
<td>● Mathematical goal or problem is clearly evident</td>
</tr>
<tr>
<td>● Mathematical goal or problem is evident with clarification or specification</td>
</tr>
<tr>
<td>● Mathematical goal or problem is not evident</td>
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Video #3
Recommendations

Create or find videos that have conceptual development and interactivity

Look for opportunities to use set-up videos

Prepare as much (or more) for the in-class time as for the video homework
Questions?

Interested in participating our study? Visit

FlippedMathStudy.net