Converting University Science and Medicine Lectures into Highly Motivating Interactive Learning Environments

Hanspeter Amend, Switzerland

Chemistry teacher
Background interactive lectures

Todays’ lectures are still performed in very conventional settings with professors reading out their slides and students watching, listening and occasionally taking some notes. Every now and then professors do interrupt their lecture flow with a question. While this does have didactic value as it triggers thought processes and activates learning there is no interaction.
About this presentation

After the previous overview this presentation started with a short demonstration on the interactive concept using the affective question: “How do you feel about the presentation so far?” The audience was given a URL to enter their responses on their smart phones. I showed my prediction of their responses and also their actual responses and commented the discrepancy.
Comparison: My prediction of clicker audience responses and actual responses

How would you rate the value of adding interactivity to university lectures?

My Prediction of Responses

- 5: 7 (63.6%)
- 4: 3 (27.3%)
- 3: 1 (9.1%)
- 2: 0 (0%)
- 1: 0 (0%)
- 0: 0 (0%)

Actual Responses

- 5: 7 (63.6%)
- 4: 1 (9.1%)
- 3: 1 (9.1%)
- 2: 1 (9.1%)
- 1: 0 (0%)
- 0: 1 (9.1%)
How would you rate the value of adding interactivity to university lectures?

Text based responses

- It's more engaging.
- Lectures were given by professors, not discussed among people in the lecture room.
- It's important to get feedback so the professor can know if the student truly understands, more deeply their chain of thought and also their interest on the subject at hand.
- The student can communicate with teacher.
- Because interactivity makes the lesson more engaging
- It would be great way for 2-way interaction
- This makes learning more hands in
About this presentation

With the demonstration just done the audience was shown an example of an interactive lecture using the interactive concept previously demonstrated.
Example: Interactive Biology Lecture given at Basel University for students in their second year
http://tinyurl.com/Muskel289
Questions Muscle

Q1. Action potential in motor neurons

Q2. The skeletal muscle

Q3. Lecture feedback
Applied approach: Inferring question answer from content

1. Posing a question relating to upcoming content
2. Showing and commenting students' responses
3. Not telling them the answer
4. Presenting upcoming content pertaining to the question
   Students were supposed to infer the answer from the content
5. Asking the very same question again
6. Showing and comment students, changed responses
7. Only then offer them the answer
1. Action potential in the motor neuron
After the content was presented in 7 slides the percentage of correct responses increased by 15%.

**Question to students**

In a normal human body an action potential in the motor neuron always leads to the contraction of the muscle innervated (no integration of postsynaptic potential).

Right or wrong?

---

**First time responses**

- Wrong: 58%
- Right: 42%

**Second time responses**

- Wrong: 43%
- Right: 57%

*Increase by 15%*
Students’ feedback on interactive lecture

The interactive lecture has increased my interest in the content presented

I would like to see interactive questions in future lectures as well
What students liked about the interactive lecture

- The interactivity
- Clear structure and question–answer interactivity
- I liked that we can answer the questions together

Suggested improvements

We need more time to work out thorough answers
2 types of questions

It is recommended that during a lecture students are asked cognitive and affective questions pertaining to the content. As an example the audience was asked such a question pair about the current presentation.
Audience question:
How do you feel about the presentation so far?

inspired

involved
absorbed

satisfied
Audience question:
In the biology lecture the same question was asked twice. Please comment this teaching concept

- It was very useful for comparison and for the lecturer to improve his/her teaching material, presentation and delivery
- It is good because we can show the true knowledge.
- It may be good for reinforcement
- I am not sure if I understand the concept
- Good approach to gauge pre and post lecture understanding of concept.
- This will show students how important it is to reflect on the question given. There may be other aspects of the lecture which can enlighten the students further, which they didn't focus on at the beginning.
- Interesting concept. It triggers the thought process of students before explaining the subject and will then show at the end how many students have understood the subject.
- Does that show comprehension?
- It helps reiterate important concepts.
- It makes sure students were really listening the lecture or not. Or it could be that it was difficult.
Clicker questions

Pros

• Quick entry of responses any number of students
• Easy to present the distribution of responses to the students
• Suitable for intense learning, strong collaboration and keeping students activated

Cons

• Students cannot enter their own thoughts
• Very restricted expression of actual understanding
• Responses always contain a certain fraction of randomly correct responses
• Options are preset and students' responses may be significantly biased
• Assessment of true understanding is severely limited
Text questions

Pros

• free entry of unbiased thoughts
• well suited to assess the level of true understanding

Cons

• Entry and evaluation of answers is time intense
• Evaluation is partially evaluator dependent
• Only a few answers can be evaluated during a lecture
4 ways of interactive questions

1. Individual response to questions
2. Short discussion with neighbor and then single choice or text response
3. Question – content – question
4. Preparatory questions at the end for the upcoming lecture
2 types of questions

While 2/3 of the audience showed a high acceptance level of using interactivity in university lectures it was thought it’s important to also present frequent concerns about the method. The audience was asked how they felt and to comment about the following 2 statements:

• "Within a given period you loose time for content by adding interactivity."
• "The preparation time for interactivity looses some of my research time."
amazed [Within a given period you lose time for content by adding interactivity.]

- 5: 0, 0%
- 4: 8, 61.5%
- 3: 1, 7.7%
- 2: 1, 7.7%
- 1: 0, 0%
- 0: 3, 23.1%

fascinated [Within a given period you lose time for content by adding interactivity.]

- 5: 0, 0%
- 4: 8, 61.5%
- 3: 1, 7.7%
- 2: 0, 0%
- 1: 1, 7.7%
- 0: 3, 23.1%
ambigious [Within a given period you loose time for content by adding interactivity.]

- 5: 1 (7.7%)
- 4: 0 (0%)
- 3: 2 (15.4%)
- 2: 4 (30.8%)
- 1: 3 (23.1%)
- 0: 3 (23.1%)

annoyed [Within a given period you loose time for content by adding interactivity.]

- 5: 0 (0%)
- 4: 0 (0%)
- 3: 2 (15.4%)
- 2: 2 (15.4%)
- 1: 3 (23.1%)
- 0: 6 (46.2%)
Interaction is very important especially for learning content.

Question seems confusing. But I love the presentation. So many great insights!

To validate content learning can be built into the questions. Interactivity reinforces learning.

Time lost for content is time gained for students’ independent thinking and reflection.

To validate content learning can be built into the questions. Interactivity reinforces learning.

It's ok to lose a bit of time. Get valuable feedback on the understanding of the topic instead.

It's good interaction, but at the same time it loses the 'real' conversation.

It doesn't have to be. Smartly designed interactivity can be engaging and content-packed at the same time

Level of interactivity should depend on the type of content presented and what is expected out of the interaction i.e. should improve content delivery
amazed [The preparation time for interactivity looses some of my research time.]

fascinated [The preparation time for interactivity looses some of my research time.]
ambigious [The preparation time for interactivity looses some of my research time.]

<table>
<thead>
<tr>
<th>Rating</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>2</td>
<td>18.2%</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>9.1%</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>9.1%</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>9.1%</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>36.4%</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
<td>18.2%</td>
</tr>
</tbody>
</table>

annoyed [The preparation time for interactivity looses some of my research time.]

<table>
<thead>
<tr>
<th>Rating</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>9.1%</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>9.1%</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>27.3%</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>54.5%</td>
</tr>
</tbody>
</table>
Audience responses on the following query
Please comment the following concern about interactivity:
“The preparation time for interactivity looses some of my research time.“

• The responses provided confuse me. But I think interactivity is highly important for qualitative and real research.
• If interactivity is part then the lesson, it is also part of the research. No time is lost.
• Not at all because student feedback will inform the teacher of what students need.
• I really can see the reason why lecturers had to come up with this method. Maybe very challenging to teach.
• I agree, designing interactivities while rewarding are immensely time-consuming activities
• Interactivity is only worth it if it really does improve content understanding among students
3140413@gmail.com
References and backup slides
Innervation; organization of the monosynaptic reflex

Monosynaptic reflex:

- Stretch activates sensory signal
- Action potential arises
- Action potential travels along the Ia afferent fibres
- Motor Neuron is activated
- Action potential travels along the alpha motor neuron-fibres
- Muscle contracts
- Motor Neuron, which innervates the antagonistic muscle is inhibited
Innervation; organization of the monosynaptic reflex

Monosynaptic reflex:

- Stretch activates sensory signal
- Action potential arises
- Action potential travels along the la afferent fibres
- Motor Neuron is activated
- Action potential travels along the alpha motor neuron-fibres
- Muskel contracts
- Motor Neuron, which innervates the antagonistic muscle is inhibited
Innervation; the neuromuscular synapse

Connection of motor neurons and muscle fibres

Muscle fibers innervated by a single motor neuron
Innervation; the neuromuscular synapse I
Innervation; the neuromuscular synapse II

Muscle fiber

Motor end-plate

Nerve

(Uehara and Desaki, in Salpeter, 1987; Ed.)