CF Education Workshop Series, 05.10.18

"Who Wants to Explain Figure 1?"

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Strategies to Optimize In-Class Paper Discussions

Why do we discuss scientific articles in class?

*Take ~ **1** minute to think on your own. I will then ask for volunteers to share their ideas with the group.*

What makes for a “successful” in-class paper discussion?

*Take ~ **1** minute to think on your own. I will then ask for volunteers to share their ideas with the group.*

How do we know that a paper discussion *was* "successful"?

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Why do we discuss scientific articles in class?

What makes for a "successful" in-class paper discussion?

How do we know that a paper discussion *was* "successful"?

…Questions to consider before you even begin planning the specifics of your discussion

Learning Objectives

- **Describe** the role of the instructor in the planning/execution of paper discussions
- **Explain** the process by which one would "backwards design" a paper discussion
    - **Provide** examples of specific learning objectives and means to assess whether the objectives were met
- **Evaluate** the usefulness of different question types that are commonly posed to students
- **Describe** teaching strategies that promote student engagement and inclusivity
- **Apply** some of the principles described today through in-class examples

Backwards Design: A General Approach to Course Design

(For your course)

Identify Desired Results

Students should be able to analyze the strengths/weaknesses of different experimental approaches

↓

Determine Acceptable Evidence

Given a description of an experiment, students will be able to identify advantages and caveats of the method and propose alternative, complementary approaches in a written assignment

↓

Plan Learning Experiences and Instruction

We will practice this skill by having students read and discuss papers that use a variety of experimental approaches

Wiggins & McTighe, 2005

Benefits of Paper Discussions as Instructional Tools

- An example of a "pedagogy of engagement"

"Learning 'about' things does not enable students to acquire the abilities and understanding they will need for the twenty-first century. We need new pedagogies of engagement that will turn out the kinds of resourceful, engaged workers and citizens that America now requires."

- Russell Edgerton

Edgerton, 2001

Benefits of Paper Discussions as Instructional Tools

- Group learning activities like paper discussions alter the roles of the instructor and students

Students:

Passive listeners	→	**Problem solvers, contributors to knowledge**
Low expectations for preparing for class	→	**High expectations for preparing for class**
Viewing instructors and textbooks as only authorities	→	**Viewing themselves and their peers as valuable sources of knowledge**

Instructor:

Imparter of knowledge	→	**Designer and facilitator of learning experiences**

Nilson, 2010; Smith *et al.*, 2005

Benefits of Paper Discussions as Instructional Tools

- Group learning activities like paper discussions alter the roles of the instructor and students

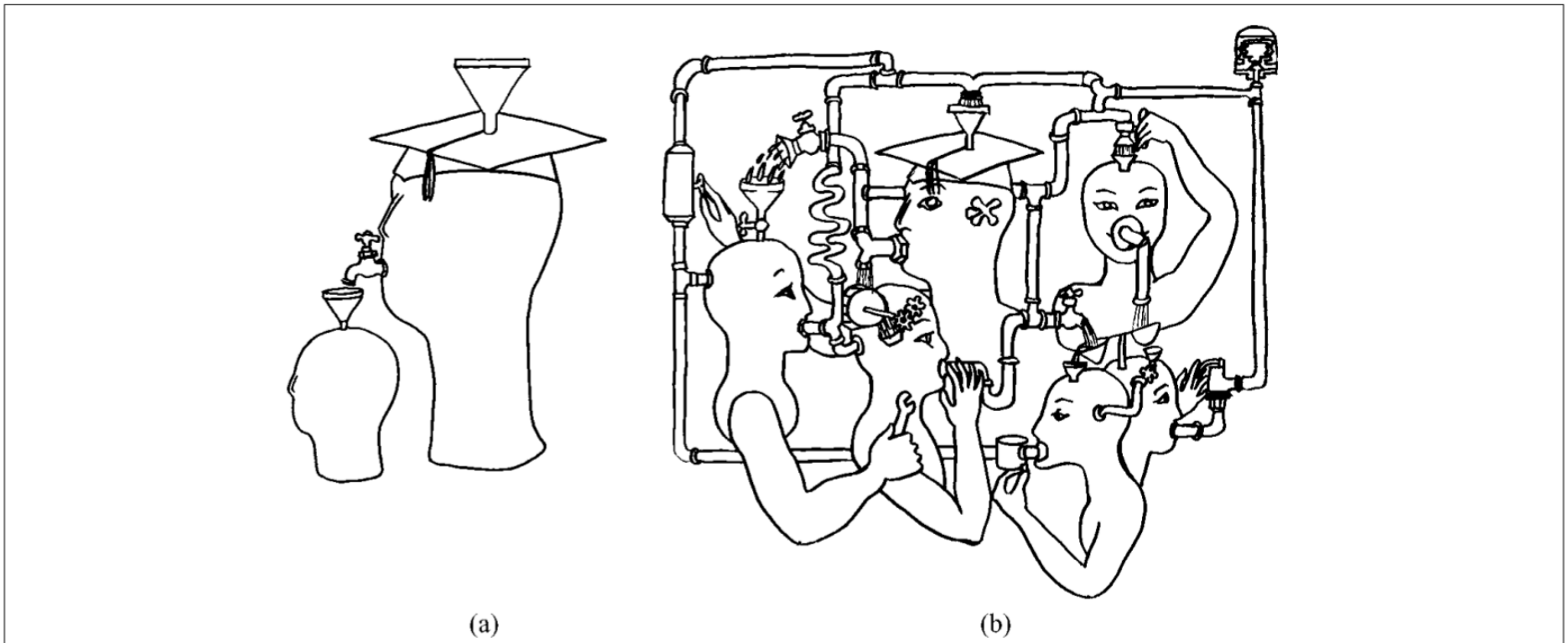

Figure 1. Two models of the classroom-based teaching learning process, as drawn by Lila Smith in about 1975. (a) "Pour it in" model, (b) "Keep it flowing" model.

Smith *et al.*, 2005

Backwards Design: Applies to Instructional Tools, Too!

(For your course)

Identify Desired Results

↓

Determine Acceptable Evidence

↓

Plan Learning Experiences and Instruction

Students should be able to assess the merits and limitations of different experimental approaches

↓

Given a description of an experiment, students will identify strengths and caveats of the method and propose alternative, complementary approaches in a written assignment

↓

We will practice this skill by having students read and discuss papers that use a variety of experimental approaches

(For your paper discussion)

Identify Desired Results

↓

Determine Acceptable Evidence

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Plan Learning Experiences and Instruction

Wiggins & McTighe, 2005

Backwards Design, as Applied to Paper Discussions

Why do we discuss scientific articles in class?

Backwards Design, as Applied to Paper Discussions

~~Why do we discuss scientific articles in class?~~

Why are we doing *this specific paper discussion* activity?

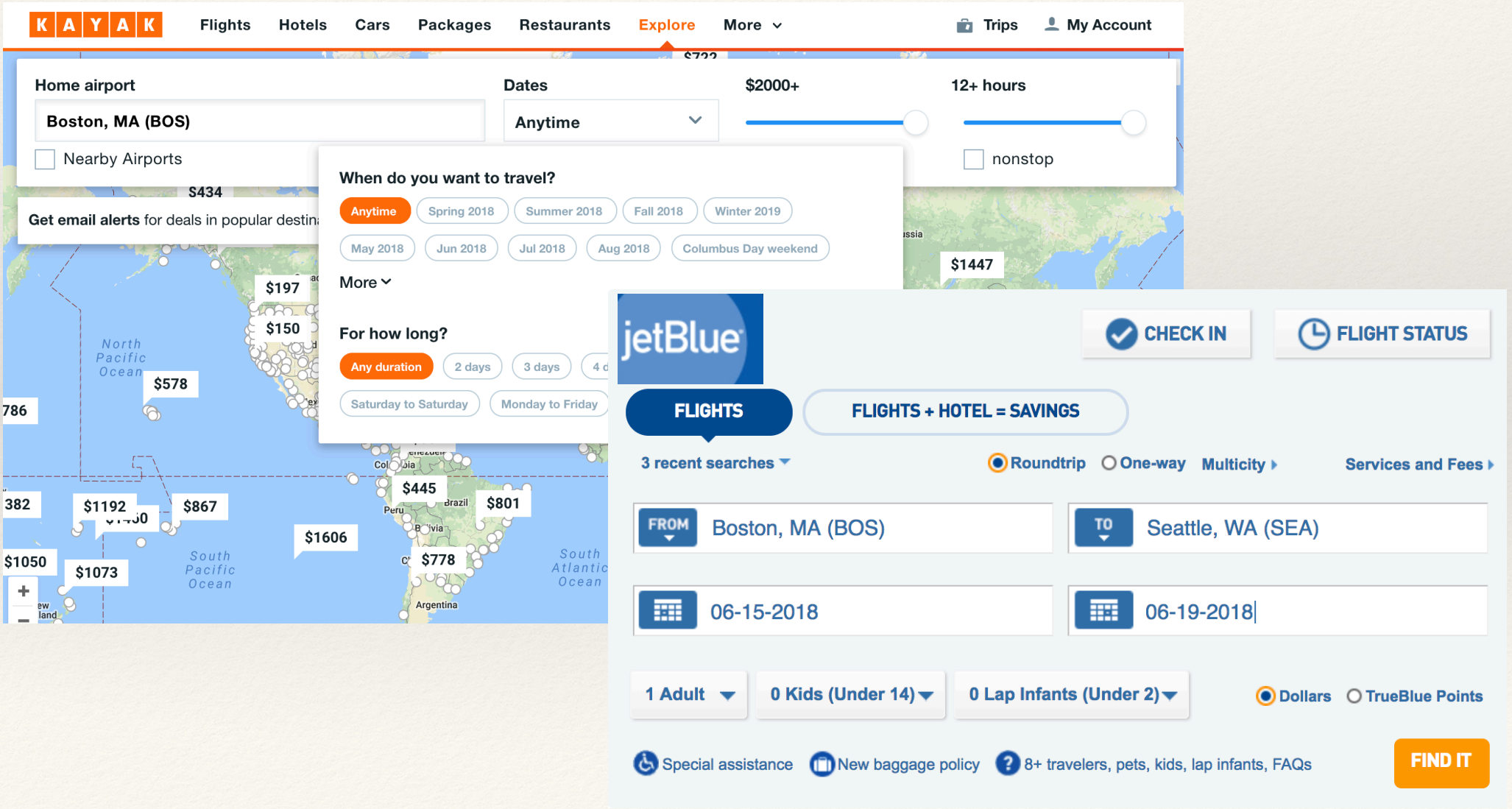
- We select papers to discuss based on:
  - Content/topic
  - Experimental methodology
  - Style (e.g. scientific storytelling)
  - Illustrative value (e.g. highlight a controversy in the field)

Remember: any paper can be used for many reasons…too many, in fact, to comprehensively cover in a single class

Backwards Design, as Applied to Paper Discussions

~~Why do we discuss scientific articles in class?~~

Why are we doing *this specific paper discussion* activity?



Backwards Designing a Paper Discussion

Identify Desired Results

↓

Determine Acceptable Evidence

↓

Plan Learning Experiences and Instruction

Wiggins & McTighe, 2005

Activity:

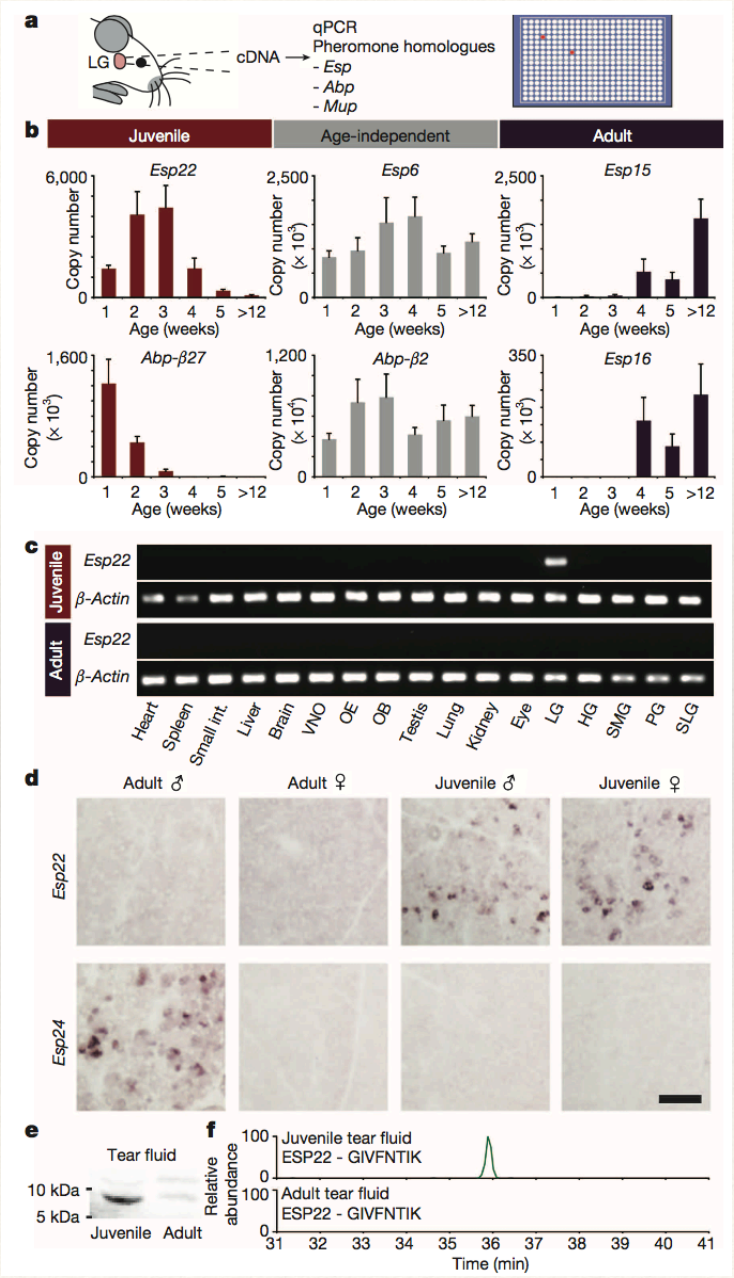
Divide into small groups and select a "discussion goal" slip. In a few minutes, you and your group will brainstorm:

1) *What students should be able to do at the end of your discussion*
2) *How you would assess whether they can actually do that*

Activity

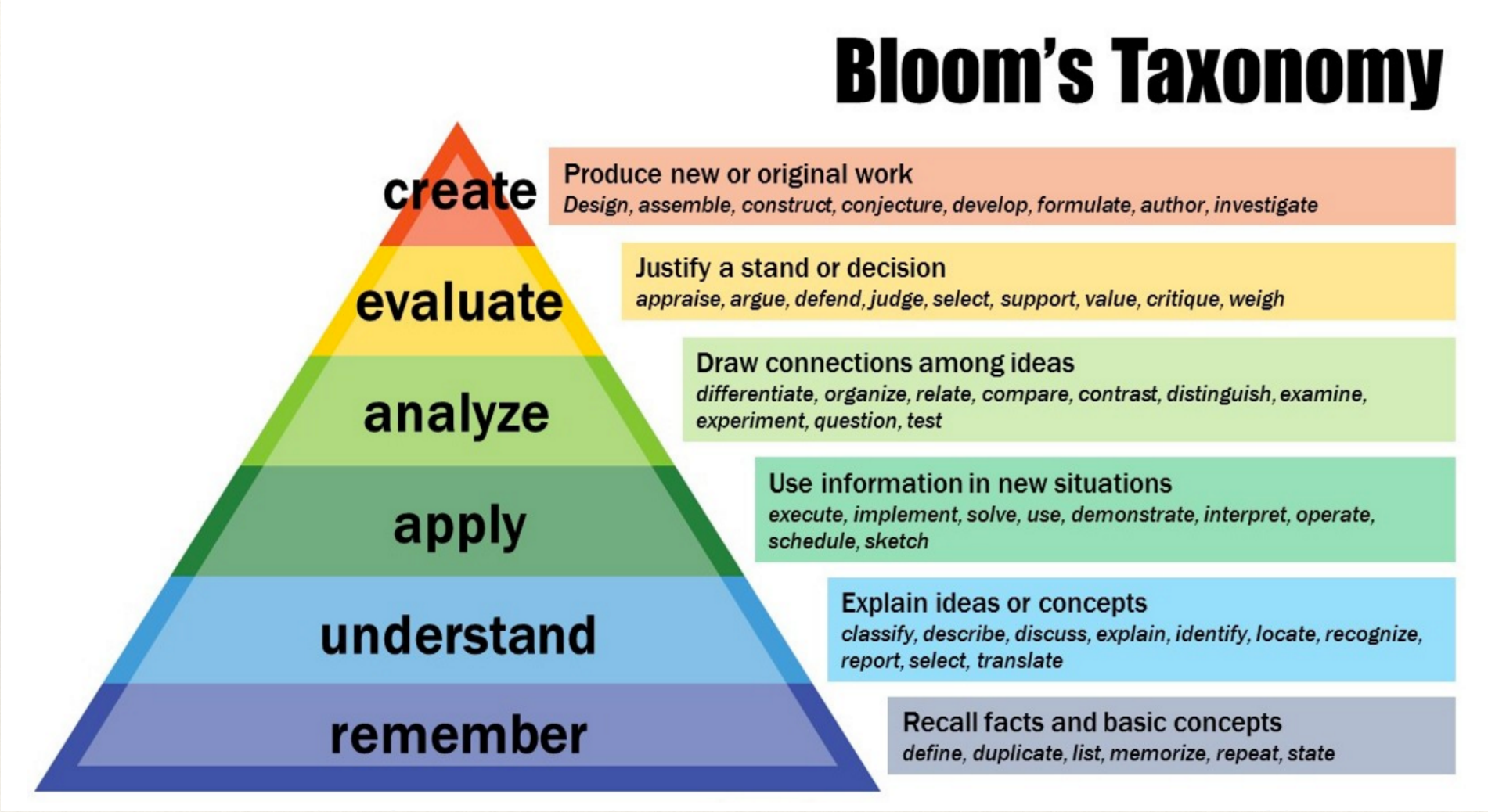
A juvenile mouse pheromone inhibits sexual behaviour through the vomeronasal system

David M. Ferrero[1], Lisa M. Moeller[2], Takuya Osakada[3], Nao Horio[3], Qian Li[1], Dheeraj S. Roy[1], Annika Cichy[2], Marc Spehr[2], Kazushige Touhara[3,4] & Stephen D. Liberles[1]



Ferrero *et al.* 2013

Articulating Specific Learning Objectives (What Students Can Do)



Modified Bloom's Taxonomy, https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/

Articulating Specific Learning Objectives (What Students Can Do)

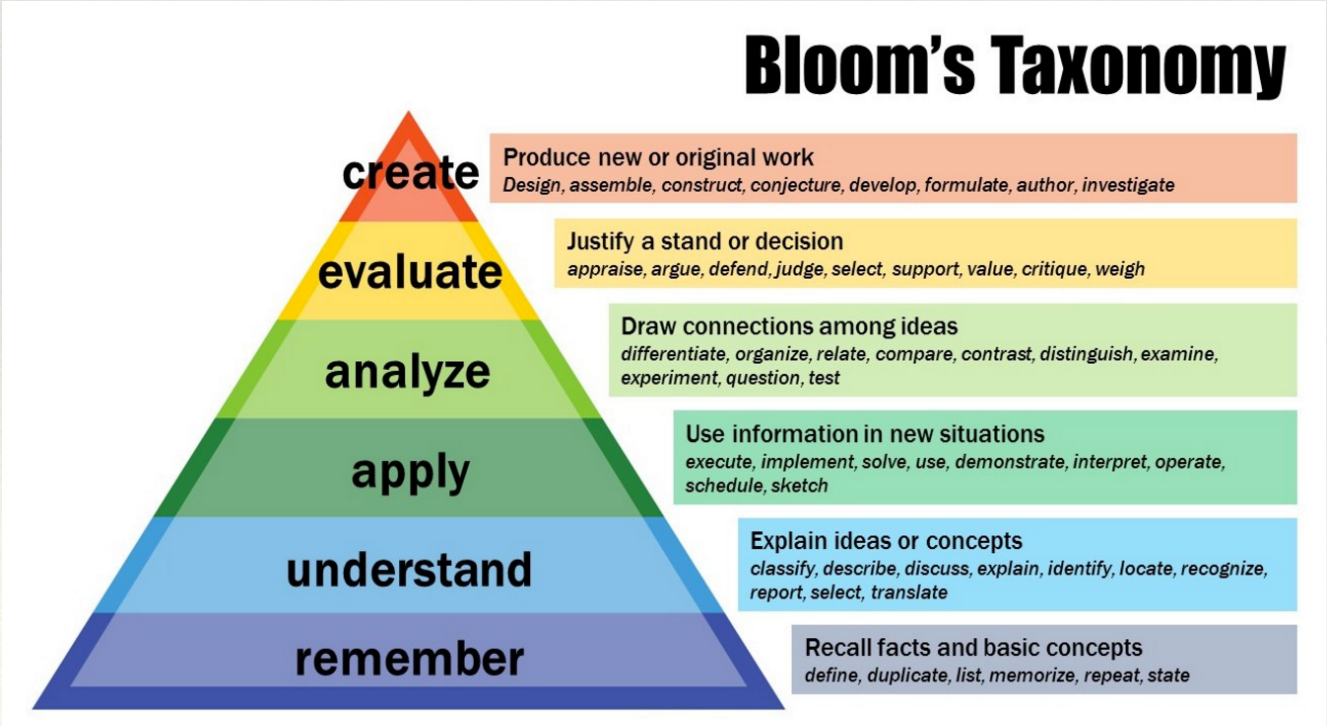
Activity:

*Take ~ **5 minutes** in your group to brainstorm at least one example of:*

1) What students should be able to do at the end of your specific discussion

2) How you would assess whether they can actually do that

*At the end of this time, the **person with the most recent birthday** from each group will report out to the class.*



Assessing "If It Worked"

What makes for a "successful" in-class paper discussion (and how will we know it *was* successful)?

It's a "success" if… (Evidence of meeting objective)	**I'll determine whether it worked by… (Assessment)**
Students can explain the experimental methods from the paper	* Having students ***explain the methods to the class*** (probes only a few students) * Using ***exit slips*** to have all students describe a few key methods in words
Students can propose follow up experiments to the paper	* Having students submit a ***homework assignment*** before class in which they propose follow up experiments * Asking students to ***design experiments as groups*** during class (or individually, in writing, at the end of class)
The class as a whole is engaged	* Taking note of individual students' contributions to the discussion, quiet lulls, distracted behaviors (e.g. being on computers) * ***Survey students*** after class (e.g. have them ***self-reflect*** and "grade" their own contributions)

Remember: "Success" is in the eye of the learning objective

Setting the Class up for Success

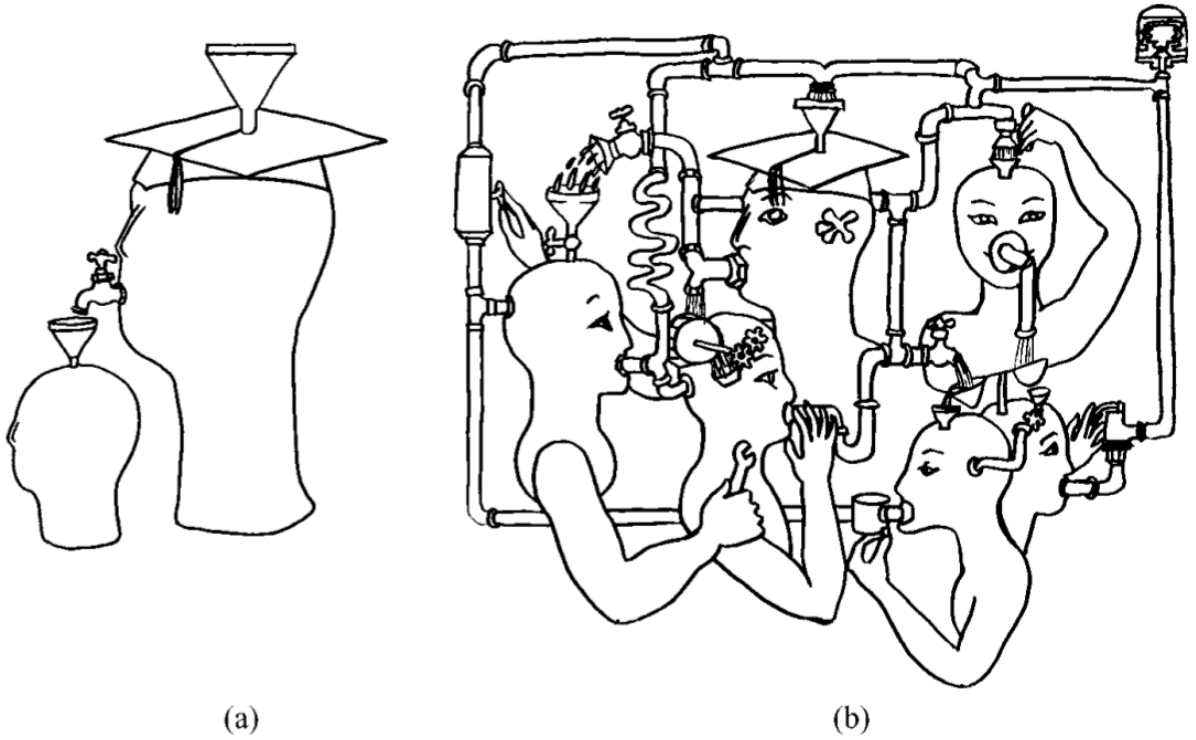


Figure 1. Two models of the classroom-based teaching learning process, as drawn by Lila Smith in about 1975. (a) "Pour it in" model, (b) "Keep it flowing" model.

In other words, how to "Keep it flowing?"

Smith *et al.*, 2005

How to "Keep it Flowing": Structure Matters!

Plan Learning Experiences and Instruction

Design a "Teachable Unit"

…That is, an instructional unit (e.g. paper discussion activity) that:

1) Is designed to **engage all students** in learning
2) Is designed to **provide feedback** to instructors and students about learning
3) **Explains how the activities and assessments are designed** to help diverse students achieve the learning goals
4) Contains **learning goals** that represent that nature of science
5) Contains **all the information** that another instructor would need to carry out the unit and accomplish the learning goals, including student materials and handouts

Handelsman, Miller, & Pfund, 2007

How to "Keep it Flowing": Structure Matters!

Plan Learning Experiences and Instruction

Prime the discussion

- Pre-class HW questions or assignment
- Pre-class quiz
- Class prep (e.g. read extra background, write questions forclass, prepare to lead a discussion, etc.)

Carry out in-class discussion

- Student presentations / chalk talks
- Small group discussions
- "Jigsaw" activities
- Mapping out key concepts / ideas
- In-class assignments (e.g. design an experiment)

Wrap up at end or after class

- "Minute papers" or "Exit slips"
- Student surveys
- Online discussion activity
- Relate content from the day to other topics in the course

Use all three of these components to support your learning objectives!

How to "Keep it Flowing": Questions Matter!

1. How did the authors identify the pup pheromone? It was qPCR, right?

2. What conclusions can you draw from that experiment?

3. Who wants to explain figure 1?

4. Did the researchers run a control for that experiment?

5. In your own words, how did the authors analyze their data?

6. Which data support the authors' claim that _____?

7. So what did you guys think about the paper?

8. How are qPCR and ISH similar? How are they different?

9. How would you design an experiment to test the hypothesis that ____?

10. Why did the authors use that approach, what was their hypothesis, how did they interpret the results?

Activity:

In your small groups, take ***~ 5 minutes*** *to classify these questions according to how useful you think they are for paper discussions. A notetaker will write out your groupings and note the rationale for your decisions.*

Notetaker: *Middle name starts closest to A;* ***Reporter:*** *Middle name starts closest to Z*

How to "Keep it Flowing": Questions Matter!

Good

Type of Question	Explanation	Example
Knowledge	Simple questions that test for content knowledge of subject matter	What is the purpose of the mitochondria? Describe …? Who, what, where, how ….?
Comprehension	Explain, interpret, give examples, summarize concepts in own words	What was the contribution of ? Retell … ?
Application	Requires application of knowledge (use of rules, facts, principles)	How is … an example of? How is … related to …? Why is … significant?
Analysis	Requires application of principles in new settings	Compare and contrast … with …? What are the parts or features of ? What evidence do you have for . . . ? Outline/ diagram . . .
Synthesis	Requires combining ideas	How would you design … How would you suggest . .? What might happen if you combine X with Y ?
Evaluation	Requires making a judgement	Do you agree with …? What criteria would you use to assess …? What is the most important . . ? What do you think about . . ?

Not-So-Good

Non Question	Example	Discussion and Tips
Overly general opening question	So, what do you guys think about democracy?	This question is too general and it requires students to transition instantly to a discussion environment without any introduction or warm up.
Filler-questions	Do you have any questions? Did you understand? You already know all this, don't you? Shall I repeat this?	Usually gets no response because no one will want to admit to not understanding the material or "look stupid" in front of the class.
Unanswerable questions	Do you still believe in Santa Claus?	The double jeopardy question. Answering no means that you used to believe in Santa Claus even if you never did.
Fuzzy questions	Why is parliament set up that way? What should Thompson have done in that case?	Overly general and not clear what is being asked. Try to focus questions on a main issue or single topic.
Asking & answering questions	Who won the last federal election? It was Stephen Harper with a minority government, wasn't it?	Ask one question and avoid giving the answer. Wait at least 5 seconds before saying anything more. If necessary repeat or rephrase the first question to encourage response.
Yes or No questions or one-word answer questions.	Did Alexander Graham Bell invent the telephone? In what year did Canada patriate the constitution?	Of limited use in keeping discussions going but can be OK in some situations as a prelude to other questions or at the beginning of class.
Run-on Questions	How did Wayne Gretsky become the premier hockey play in the NHL, did he win any awards, what sort of a coach is he?	Too many parts in one question and it changes direction at the end. Ask one question at a time.

https://carleton.ca/edc/wp-content/uploads/Effective-Questions-for-Leading-Discussions.pdf

How to "Keep it Flowing": Questions Matter!

Typologies of Good Discussion Questions

McKeachie's Categories

* Comparative questions
* Evaluative questions
* Connective and causal effect questions

Brookfield and Preskill's "Momentum" Questions

* Questions requesting more evidence
* Clarification questions
* Cause-and-effect questions
* Hypothetical questions
* Open questions
* Linking or extension questions

Gale and Andrew's "High-Mileage" Types

* Brainstorming questions
* Focal questions *(choose a position and defend it with evidence/reasoning)*
* Playground questions *(students develop their own themes/concepts for interpreting/analyzing the material)*

Described in Nilson, 2010

How to "Keep it Flowing": Increasing Engagement

Prime the discussion → Carry out in-class discussion → Wrap up at end or after class

Inclusive teaching strategies

Increasing Engagement With Inclusive Teaching

Inclusive teaching strategies: *Strategies that address the needs of diverse learners and which contribute to an overall inclusive learning environment in which students feel equally valued*

- Set ground rules for civil discussion; create a non-judgmental space (e.g. "there are no stupid questions", don't chastise students when they get something wrong)
- Incorporate diversity into your paper selections, and highlight it! (e.g. authors representing different ethnic groups, types of institution, level of training)
- Give attention to all students as equally as possible (and praise students equally for equal-quality responses)

Tanner & Allen, 2007; Nilson, 2010

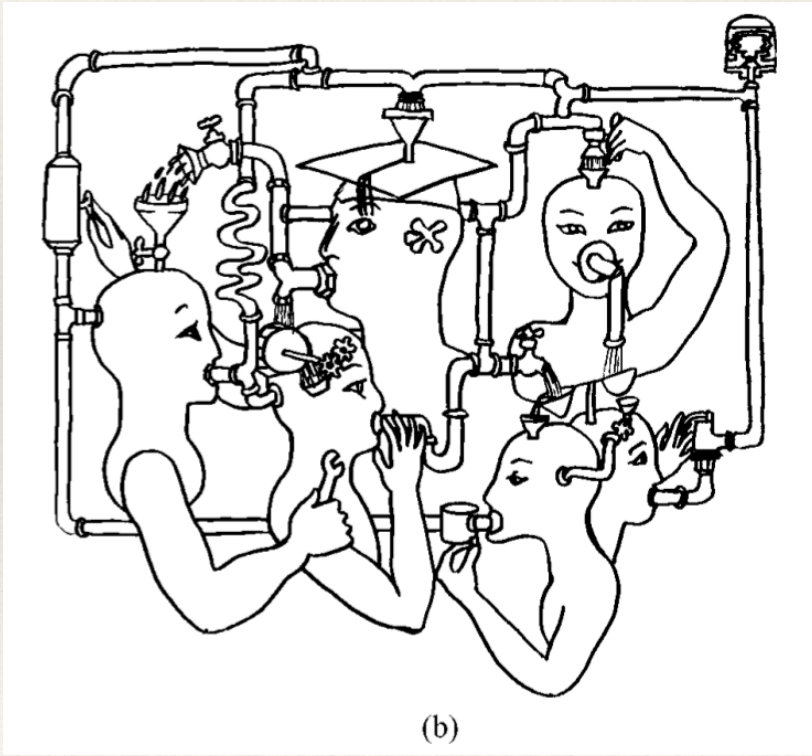
Increasing Engagement With Inclusive Teaching

Structure Matters: Twenty-One Teaching Strategies to Promote Student Engagement and Cultivate Classroom Equity

Kimberly D. Tanner

5 Categories of Strategies:

- Giving students opportunities to think and talk about biology
- Encouraging, demanding, and actively managing the participation of *all* students
- Building an inclusive and fair classroom community for *all* students
- Monitoring behavior to cultivate divergent biological thinking
- Teaching *all* of the students in your classroom



(b)

Tanner, 2013

Increasing Engagement With Inclusive Teaching

Giving students opportunities to think and talk about biology

_____ 1. Wait time

_____ 2. Allow students time to write

_____ 3. Think–pair–share

_____ 4. Do not try to do too much

Encouraging, demanding, and actively managing the participation of *all* students

_____ 5. Hand raising

_____ 6. Multiple hands, multiple voices

_____ 7. Random calling using popsicle sticks/index cards

_____ 8. Assign reporters for small groups

_____ 9. Whip (around)

_____ 10. Monitor student participation

Building an inclusive and fair biology classroom community for *all* students

_____ 11. Learn or have access to students' names

_____ 12. Integrate culturally diverse and relevant examples

_____ 13. Work in stations or small groups

_____ 14. Use varied active-learning strategies

_____ 15. Be explicit about promoting access and equity for *all* students

Monitoring (your own and students') behavior to cultivate divergent biological thinking

_____ 16. Ask open-ended questions

_____ 17. Do not judge responses

_____ 18. Use praise with caution

_____ 19. Establish classroom community and norms

Teaching *all* of the students in your biology classroom

_____ 20. Teach them from the moment they arrive

_____ 21. Collect assessment evidence from every student, every class

Tanner, 2013

Bring it All Together…

Activity:

(Revisit the Liberles paper)

In your groups, spend ***~ 5 minutes*** *brainstorming at least one discussion question that would support your learning objective and one teaching strategy for your paper discussion that would foster equity in the classroom. Each group will select one person to report to the class.*

Thanks!

For More Information, Comments, or Questions:
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