You let them talk in lectures?
Student discussion as formative assessment

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“Effective science communication is an art involving creativity, imagination, and innovation, along with planning, practice, decision making, and evaluation. Teaching is a scholarly activity, benefiting from research, collective experience, and critical thinking throughout. Yet with all the demands on our time we seldom have an opportunity to think through the entire process.”

(Committee on Undergraduate Science Education, 1997)
University science teaching:

- Has a strong focus on transmission of knowledge;
- Less emphasis on developing understanding of the nature of science;
- First-year classes often large;
- Standard lecture format with little opportunity for active student engagement;
- Assessment processes often summative & encourage surface learning.
"I expect you all to be independent, innovative, critical thinkers who will do exactly as I say!"
Nature of science:
After 3 years of study, 3\textsuperscript{rd}-year biology students had no better understanding of the nature of science than 1\textsuperscript{st}-year students at the beginning of their university career.

(Campbell & Cooke, unpub.)
Issues for first-year university students:

• Problems with new concepts;
• Inability to see the ‘big picture’;
• Differing cultural and educational backgrounds;
• Large amount of course content;
• Lack of independent learning skills.
“Yeah, they then come to university and expect to be fed everything, they expect handouts, they expect everything on a plate and then they expect to know that everything that could possibly be in the exam is in the handouts …”

(Campbell et al. 2008)
“… to translate [other teaching methods] into a sort of, practical classroom situation was quite difficult especially when you’re got all this course material where you’ve got to get through, it’s lovely to have, let’s have group sessions and let’s do this, you know, you just don’t have time to do it all.”

(Campbell et al. 2008)
Excessive content (& inappropriate assessment) may see students using surface learning strategies to cope…
Formative assessment: “the process used by teachers and students to recognise and respond to student learning in order to enhance that learning, during the learning.”

Bell & Cowie (2001)
Concept mapping & feedback on learning
transcription
| translation
| needed for
| gene expression
| which
| produces proteins
| is under control
| so that
| cells can differentiate
| energy is not wasted

eukaryotes
by
heterochromatisation - DNA wound so tightly around histones that it can't be transcribed
modeled by
X chromosome inactivation

prokaryotes
by
operons
| e.g.
| lac operon
| which is
| a set of 3 genes
| controlled by
| one promoter
| so they are
| transcribed together

permease
B-galactosidase
transacetylase
| work together to
| break down lactose
| which is
| energy source
“[Problem-solving sessions] were also the most satisfying lectures of all because you know, we can then nut out the problem and I can help the students and I know they are learning.”

(Campbell et al. 2008)
But – more easily achieved in tutorial classes. Harder to manage in lecture rooms (less opportunity for teacher-student discussion).
“I think [lectures are] a shocking way of teaching. I don’t think it’s a good way of learning but it’s a good way of disseminating information and I think, I try and combine teaching with the dissemination of information.”

(Campbell et al. 2008)
Talking in lectures as formative assessment
(From Nicol & Macfarlane-Dick, 2006)
Good feedback practice:

- Helps clarify what good performance is
- Facilitates development of self-assessment (reflection) in learning;
- Delivers high-quality information to students about their learning;
- Encourages teacher and peer dialogue around learning;
- Encourages positive motivational beliefs and self-esteem;
- Provides opportunities to close the gap between current and desired performance;
- Provides information to teachers that can be used to shape teaching.

(From Nicol & Macfarlane-Dick, 2006)
Quick Quiz Q.4

Do plants need oxygen? *(Select one)*

A. no
B. yes, but only during the night time
C. yes, during the day and at night
D. don’t know / not sure
Quick Quiz Q.4

Do plants need oxygen? *(Select one)*

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B. yes, but only during the night time
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D. don’t know / not sure
Quick Quiz Q.6

Where is DNA found in your body?
A. In all cells involved in reproduction but no other cells
B. In the sex cells (eggs and sperm) only
C. In all cells, including cells involved in reproduction
D. In cells involved in reproduction and in a few other cells
E. Other:
F. Don't know / not sure
**Quick Quiz Q.6**

**Where is DNA found in your body?**

A. In all cells involved in reproduction but no other cells

B. In the sex cells (eggs and sperm) only

C. In all cells, including cells involved in reproduction

D. In cells involved in reproduction and in a few other cells

E. Other:

F. Don't know / not sure
What will happen? Explain in terms of osmosis.

5% salt

1.5% salt
Worm’s body fluids more concentrated than the surrounding water i.e. it has a lower water potential ($\psi$) & is hyperosmotic to its surroundings.
5% salt
1.5% salt

Water moves into the animal from high $\psi$ to low $\psi$, and the animal’s tissues swell.
“I am absolutely impressed by the way you get students to interact with you and with each other.”

“[You help us to] find out what we didn’t know and show us what you think we should know.”