CBE—Life Sciences Education
Vol. 12, 12–18, Spring 2013

Essay

The Teaching Demonstration: What Faculty Expect and How to Prepare for This Aspect of the Job Interview

Michelle K. Smith,*† Mary Pat Wenderoth,‡ and Mary Tyler*

*School of Biology and Ecology and †Research in STEM Education Center, University of Maine, Orono, ME 04469-5751; ‡Department of Biology, University of Washington, Seattle, WA 98195-1800

Submitted September 14, 2012; Revised November 18, 2012; Accepted January 2, 2013
Monitoring Editor: Linnea Fletcher

Many institutions require candidates for faculty positions to present a teaching demonstration as part of the interview process. To help job candidates prepare for this and to assist departments in planning how to structure this portion of the interview, we surveyed biology faculty from community and liberal arts colleges and master's- and PhD-granting institutions concerning how their departments assess teaching potential. We also asked survey respondents to share advice on how candidates can prepare for teaching demonstrations. Here we report on the survey results and offer suggestions based on comments from respondents.

INTRODUCTION

It is an all-too-familiar scenario: The job candidate for a biology department faculty position gives an outstanding research seminar, showing skill in formulating a hypothesis, carrying out meaningful research, analyzing data, forming conclusions, and translating work into the larger picture of science and society—it is an effective demonstration of the process of science. However, during the teaching demonstration portion of the interview, rather than engaging the audience in the learning process, the candidate delivers a presentation with too many slides, each of which is packed with factual information. The candidate interprets all the graphs and data for the audience, presents conclusions, and only intermittently asks whether the audience has any questions. Furthermore, the job candidate expects the audience to sit passively and absorb knowledge. In short, the candidate shows little ability to help others learn the process of science.

The wide discrepancy between the quality of the job candidate's research talk and teaching demonstration indicates inadequate preparation for the teaching component of the job interview. There are a number of reasons that can explain lack of preparation, but two major ones are: 1) not knowing what is expected during the teaching demonstration and 2) a lack of effective practice of the desired skill. Though each job candidate has been attending class since he or she was a child, few have had enough practice teaching, and even fewer have delineated the crucial aspects of effective teaching.

To help job candidates better understand faculty expectations of the teaching demonstration and to help departments think about how to structure this portion of the interview, we canvassed 113 biology faculty from a variety of institutions across North America (Table 1) as to the role and assessment of the teaching demonstration in the interview process. We asked faculty who vote on tenure-track hiring decisions and are in departments in which a teaching demonstration is part of the interview process to identify the elements of an effective teaching demonstration and to give advice as to how candidates can prepare for this aspect of the interview. The results of the survey, as well as representative comments from survey respondents, are presented below.

The Importance of the Teaching Demonstration

Our survey shows that 62% of biology departments require a teaching demonstration. However, the inclusion of a teaching demonstration as a component of the interview process varies by institution type, with teaching demonstrations being most common at community colleges (Table 2). When teaching demonstrations are included in the interview process, candidates are most often asked to prepare materials for an undergraduate course for majors, irrespective of

DOI: 10.1187/cbe.12-09-0161
Address correspondence to: Michelle Smith (michelle.k.smith@maine.edu).

Table 1. Demographic information on survey respondents

Institution type	Number of respondents	Current position
Community college	30	Full professor: 40% Associate professor: 13% Assistant professor: 10% Lecturer: 37% Other: 0%
Primarily undergraduate institution	35	Full professor: 26% Associate professor: 37% Assistant professor: 31% Lecturer: 3% Other: 3%
Master's degree granting	7	Full professor: 14% Associate professor: 72% Assistant professor: 14% Lecturer: 0% Other: 0%
PhD granting	41	Full professor: 35% Associate professor: 26% Assistant professor: 21% Lecturer: 16% Other: 2%

institution type. Faculty members of the department and hiring committee typically attend the presentations. Students are also present in about one-third of the cases. Regardless of the audience, candidates are typically told to treat the audience as though they were students.

Our survey also showed that faculty members think that the teaching demonstration is an important part of a job interview. Namely, 47.0% of respondents said that the candidate's performance on the teaching demonstration carries equal weight with the research talk, and 28.1% said that the teaching demonstration carries more weight than the research talk (results by institution type in Table 3).

One reason faculty are placing importance on the teaching demonstration portion of the interview, according to 98.2% of respondents, is that teaching plays some role in determining tenure and promotion, with 57.1% saying teaching is heavily weighted (results by institution type in Table 4). Given the cost in time and money of conducting faculty searches, as well as the financial investment the college is making with each hire, it is incumbent on the department to select the job candidate who shows high potential in both research and teaching abilities. As a survey responder noted:

> It is amazing how often applicants are ill-prepared for the teaching demonstration; if the teaching demonstration cannot be the "best" lecture they have ever prepared and given, how well will they prepare for the daily lectures of a course?

Another reason faculty want to hire candidates who demonstrate potential as effective teachers is that, since 2000, a number of national reports have made calls to action to improve science teaching (National Research Council, 2000, 2003; American Association for the Advancement of Science, 2010; Anderson *et al.*, 2011). These reports conclude that learning is most effective when it is an active endeavor incorporating inquiry-based learning strategies and integrating all steps of the scientific process into the learning process. A wealth of studies indicate that few students learn while sitting passively in lecture taking notes (e.g., Bonwell and Eison, 1991; Bransford *et al.*, 2000; Knight and Wood, 2005; Ruiz-Primo *et al.*, 2011). Therefore, faculty are being asked to recognize

Table 2. The requirement for job candidates to do a teaching demonstration varies by institution type

	The job candidate is required to give . . .				
Institution type	just a research talk (%)	a research talk and a teaching demonstration (%)	just a teaching demonstration (%)	Other[a] (%)	*n*
Community college	0	6.7	83.3	10.0	30
Primarily undergraduate institution	34.3	34.3	20.0	11.4	35
Master's degree granting	42.9	57.1	0	0	7
PhD granting	43.9	36.6	0	19.5	41

[a]"Other" includes alternatives to teaching demonstration, such as informal discussion about teaching or chalk-talk (with chalk only, no slides).

Table 3. The importance of the teaching demonstration relative to the research talk at different institution types

	The candidate's performance on the teaching demonstration carries . . .			
Institution type[a]	*more* weight than his/her performance on the research talk (%)	*less* weight than his/her performance on the research talk (%)	*equal* weight with his/her performance on the research talk (%)	n^b
Primarily undergraduate institution	41.7	0	58.3	12
Master's degree granting	50.0	25.0	25.0	4
PhD granting	0	53.3	46.7	15

[a]Community college is omitted, because there was only one respondent to this question.

[b]Respondents were faculty who vote on hiring decisions and are in a department in which both a teaching demonstration and a research talk are required.

Table 4. The role of teaching in tenure and promotion separated by institution type

Institution type	How much do teaching and teaching evaluations determine tenure and promotion in your department?			
	Teaching does not contribute, only research effort is important (%)	Teaching evaluations must be adequate (not bad) (%)	Teaching is heavily weighted (%)	*n*
Community college	0	14.3	85.7	28
Primarily undergraduate institution	0	14.3	85.7	35
Master's degree granting	0	57.1	42.9	7
PhD granting	4.8	78.6	16.6	42

that students must "do" science to "learn" science and their teaching methods should reflect this change.

Finally, showing teaching potential demonstrates not only that a candidate is prepared for the major task of teaching, but also that he or she is well prepared for establishing his or her own research projects. Just as research enhances teaching, it is also true that teaching enhances research. A recent study of science graduate students found that those who teach inquiry-based methods improve their research skills in formulating hypotheses and designing experiments to test these hypotheses (Feldon *et al.*, 2011). Giving a skilled teaching demonstration therefore establishes a candidate's potential as both an effective teacher and a research scientist.

Elements of an Effective Teaching Demonstration

To determine which elements of a teaching demonstration are most important, we asked survey participants to respond to 21 statements describing specific characteristics of a teaching session on a Likert scale from 1 = not important to 4 = very important (Table 5).

The top-rated statement from faculty across institution types was that the content of a candidate's teaching demonstration be accurate (Q21), which indicates that, first and foremost, faculty feel it is important that the job candidate have expertise in his or her discipline. Disciplinary expertise includes factual knowledge, as well as a deep understanding of the conceptual frameworks that underlie and connect these facts. However, to be an effective instructor, the candidate should also demonstrate pedagogical content knowledge, that is, the ability to select, organize, and properly implement the appropriate teaching method to help students meet the challenges of mastering the material (Shulman, 1986). Statements aligned with the importance of pedagogical content knowledge were also ranked highly in our survey, including: the presentation is understandable to students (Q12), the material is organized effectively (Q18), and the candidate pitches the talk at the correct level for the intended audience (Q4).

Our survey showed few differences based on institutional type in how faculty ranked the importance of specific elements in a teaching demonstration. Only two statements showed a significant difference: whether "the candidate discusses how he/she would assess student learning on an exam or other future assignment" (Q5: Kruskal-Wallis $\chi^2 = 6.11$, df = 2, $p < 0.05$) and whether "the candidate explains why he/she is using certain teaching strategies" (Q19:

Table 5. The ranked importance of elements of a teaching demonstration[a]

	Statement	Mean score[b]
Q21.	The candidate's content information is accurate.	3.86
Q12.	The candidate's presentation would be understandable to students.	3.82
Q18.	The candidate is able to organize material effectively.	3.73
Q4.	The candidate pitches the talk at the correct level for the intended audience.	3.68
Q7.	The candidate introduces topics in a way that connects to the audience (asking questions, emphasizing the relevance of the topic, etc.).	3.63
Q9.	The candidate demonstrates his/her knowledge about the topic.	3.60
Q1.	The candidate is enthusiastic.	3.56
Q6.	The candidate appears confident in his/her ability to teach.	3.52
Q8.	The candidate covers the appropriate amount of material for the given time and level of student.	3.40
Q11.	The candidate speaks at a comfortable pace.	3.22
Q10.	The candidate's slides are easy to read.	3.20
Q14.	The candidate asks if the audience has questions during the presentation.	3.02
Q3.	When asked a question, the candidate facilitates a discussion, rather than just telling the answer.	2.66
Q13.	The candidate provides a wrap-up at the end.	2.62
Q16.	The candidate allows wait time (at least 3–5 s) for the audience to think about questions posed.	2.58
Q17.	The candidate incorporates elements of active learning (e.g. discussion, small-group work, clicker questions).	2.52
Q15.	The candidate gives a clear indication of his/her teaching philosophy.	2.48
Q5.	The candidate discusses how he/she would assess student learning on an exam or other future assignment.	2.26
Q19.	The candidate explains why he/she is using certain teaching strategies.	2.02
Q2.	The candidate brings in materials, such as a printout of slides, that he/she would hand out in class.	1.98

[a] 1 = not important to 4 = very important.

[b] Based on the opinion of 49 respondents who vote on tenure-track hiring decisions and are in a department in which a teaching demonstration is part of the interview process.

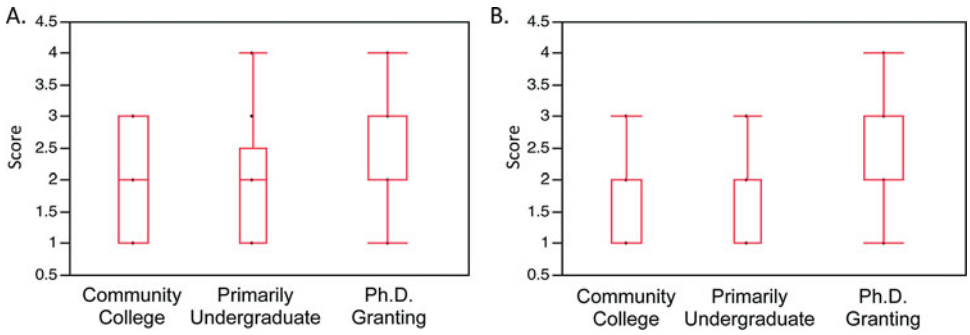

Figure 1. A comparison of how faculty from different institution types ranked the importance of two statements on the survey. (A) Responses to Q5: "The candidate discusses how he/she would assess student learning on an exam or other future assignment." (B) Responses to Q19: "The candidate explains why he/she is using certain teaching strategies." Error bars show the range limits of faculty answers.

Kruskal-Wallis $\chi^2 = 8.51$, df $= 2$, $p < 0.05$). Whether a candidate discusses assessment methods elicited a greater range of responses from faculty at primarily undergraduate and PhD-granting institutions when compared with community college faculty (Figure 1A). Whether a candidate discusses teaching strategy elicited a greater range of responses from faculty at PhD-granting institutions when compared with the other two institution types (Figure 1B).

Elements of an Outstanding Teaching Demonstration

A teaching demonstration that incorporates all the statements shown in Table 5 would certainly be impressive. As one survey responder noted: "Very few candidates are able to meet all the criteria. If a candidate does at least, say, two-thirds of those well, then s/he is going to be ranked quite highly in my mind." Given that the likelihood of a job candidate excelling at all the statements in Table 5 is small, we also wanted to determine which elements were key to making a teaching demonstration outstanding, to enable candidates to prioritize their teaching efforts.

To learn what faculty consider the key elements of an outstanding teaching demonstration, we asked the following: "What distinguishes an adequate teaching demonstration from an outstanding teaching demonstration?" The elements most frequently cited included: enthusiasm, passion for a topic, and a relaxed and confident manner.

> The outstanding candidate conveys their excitement for the topic to their audience. The outstanding candidate also conveys to their students the sense that "I can do this," along with the expectations to be achieved.

> I ask myself if I would like to enroll in a course taught by the candidate. If I am left excited about the experience and left inspired and I feel my students feel the same I would say it was an outstanding demonstration. If I could tolerate attending the candidate's class it would be considered adequate.

The use of active-learning strategies was also cited by respondents.

> If the individual can demonstrate something out of the ordinary, for example, a hands-on activity or an online simulation, the presentation will clearly stand out.

> An outstanding candidate will give us some indication that he/she will readily do more than lecture (some type of student centered teaching) upon arriving on campus.

Preparing for the Teaching Demonstration

Implementing the elements considered important in a teaching demonstration requires planning and practice. We have compiled a number of suggestions that can help job candidates as they prepare for the teaching demonstration part of their job interviews.

Follow Instructions. If you are given instructions by the department on the type of audience you are to be teaching, follow the instructions. Regardless of the makeup of the audience, it is advised that you treat them as though they were students. Furthermore, if you were told your teaching demonstration is to be pitched to an introductory biology class, do not give the same talk you would give in a graduate-level journal club.

> In my experience, the teaching demonstration can easily fall into a continuation of the research presentation, centering on the presenter's area of expertise rather than using a more balanced approach to the big picture that an undergraduate or even graduate student might need to progress.

It is helpful to start your presentation by reminding your audience of the type of course your teaching demonstration is focused on (e.g., level, expected size, educational background of students, and majors vs. nonmajors). Reviewing these details not only sends the message that you are paying attention to directions, but also reminds the audience they are playing the role of the "student." This reminder is particularly important when active-learning exercises are being used, as the faculty need to give typical student responses if the exercise is to work appropriately.

Do Some Research. Once either you or the department you are visiting has selected a topic for your teaching demonstration, find a course at your home institution similar to the one your teaching demonstration will focus on. Sitting in on this class, looking over the course textbook, and talking with teaching assistants or faculty associated with the course will give you a much better understanding of what current students know and how to make complex material accessible to them. It will also give you insight into current classroom

dynamics and management issues, topics that could easily arise during the job interview.

Cover the Appropriate Amount of Material—Less IS More. When your audience is filled with faculty members, it is difficult to remember that you are not being judged on the amount of knowledge you can convey, but on how able you are to "teach" the process of science, using the subject you are discussing.

> An outstanding demonstration would engage the audience (encouraging responses, discussion among the students), relate the material being taught to students' interests and experience, [and] not view covering any given amount material as the main goal.

Although it is common for science teachers to feel the need to cover large amounts of content, effective teaching does not sacrifice depth, problem solving, and critical thinking in the process (Coil *et al.*, 2010). Studies have shown there is a limit to the amount of information a person can process and store (Miller, 1956; Sweller, 1994). Realize, therefore, that your demonstration should only contain three to four major points that you present in a way that is accessible to students. Choose these well.

Engage Students in the Classroom. One key to facilitating learning is to engage students in the learning process (Bransford *et al.*, 2000; deWinstanley and Bjork, 2002). We identify below key aspects of how to engage students in a manner that enhances learning.

Connect with the Audience: Help Them Realize the Importance and Relevance of the Topic. To capture the attention of your audience, relate the class material to something with which your audience is very familiar yet which provides some mystery or puzzle. Alluding to something in the recent or popular press is often quite effective in producing the "hook" that will encourage attention.

When considering material that could generate student interest, keep in mind that your class will contain a diversity of individuals. This diversity can cover ethnic, socioeconomic, religious, political, and gender differences. You want your teaching demonstration to engage but not offend any sector of this broad audience.

Use Slides and the Board to Promote Learning. Many teaching demonstrations include slides, such as PowerPoint slides, but keep in mind:

> PowerPoint is a good start for some, but it isn't the whole talk and it isn't essential. What is essential is that they get their point across.

If you use slides in your teaching demonstration, each slide should help promote learning and display material so it is accessible to students. Your slides, therefore, should not be used as simply a way to convey information. For example, bulleted points are a classic way of reminding a speaker of what they want to say, but this is not an effective way to help students learn material. In fact, work in cognitive science has shown that supplying students with an extensive set of class notes actually impedes rather than enhances learning (deWinstanley and Bjork, 2002). Slides, instead, can be used to pose questions, query interpretations of graphs, and illustrate points with pictures and videos.

When incorporating graphs into your teaching demonstration, it is important that the graphs are large and readable and that all axes are labeled. Take time to orient the audience to the graph by asking the audience to explain what is depicted on each axis and to propose how the data were generated. Similarly, ask the audience to construct possible conclusions to be drawn from the data rather than just telling them your conclusions—interpretation of material is a key aspect of the student learning process (deWinstanley and Bjork, 2002).

If audience members should be writing down material you are presenting, it is best if you are writing it down as well. If a blackboard or whiteboard is available, use this to write down the information that you absolutely want the audience to write down.

> It is important that the candidate uses the board, or other technique that slows the pace for students and allows for more spontaneity than only following (a) PPT.

Use Questions to Promote Learning: "Ask, Don't Tell." Using questions to introduce an idea is an effective way to focus the audience's minds on the material that is coming. Your questions can be rhetorical or directed to elicit student discussion. In addition, it is important to verify that your audience is processing the information you are trying to convey. Job candidates will often stop periodically and ask whether there are any questions, which in a real classroom can be problematic, because students who are lost are usually reluctant to speak in front of the class. A more effective strategy is to ask a question that will diagnose whether the students actually understand the material. During your job interview, you could 1) pose a question, 2) have the audience members write down an answer and discuss their answers with their neighbors, and 3) ask the audience to share ideas. When responding to an audience member's idea, it is a good idea to try to use at least a portion of each answer to build the correct answer, while also politely correcting any errors.

Many job candidates feel uncomfortable asking questions and fielding audience responses, because they are afraid they might not be able to quickly process an answer or handle follow-up questions. If a question is asked that is difficult to answer, give yourself time to thoughtfully consider the question by turning the question back to the audience. Ask the audience to "talk to your neighbor." This approach will give you time to gather audience input to which you can add your own ideas. You do not have to know all the answers, but always acknowledge the value of a question, and tell the audience to research this out of class and bring their subsequent ideas to the next class.

Use Active-Learning Activities. Incorporating active-learning techniques into the classroom greatly enhances student learning (e.g., Bonwell and Eison, 1991; Bransford *et al.*, 2000; Knight and Wood, 2005; Ruiz-Primo *et al.*, 2011). These techniques encompass a wide variety of activities, such as small-group break-out discussions, group assignments, short in-class writing assignments, and use of personal response systems, such as clickers (Table 6 has a list of resources with information on active-learning strategies). Effectively incorporating any of these active-learning activities into your teaching demonstration can be impressive to the search committee.

Table 6. Resources to help job candidates become familiar with active learning

Topic	Resource
Information on scientific teaching methods	Handelsman JS, Miller MS, and Pfund C (2006) *Scientific Teaching*. New York: Freeman.
Classroom assessment techniques	*50 CATS by Angelo and Cross: Techniques for Assessing Course-Related Knowledge & Skills*: http://pages.uoregon.edu/tep/resources/newteach/fifty_cats.pdf
Clickers	Videos and instructor guide: www.cwsei.ubc.ca/resources/SEI_video.html Information on research relating to clickers: http://derekbruff.org/?page_id=2
Workshops	FIRST IV for postdoctoral fellows: www.msu.edu/~first4/Index.html National Academies Summer Institute on Undergraduate Biology Education: www.academiessummerinstitute.org
Meetings	Society for the Advancement of Biology Education Research: http://saber-biologyeducationresearch.wikispaces.com Lilly Conference on College and University Teaching: www.iats.com/conferences/lilly-conference

> Outstanding teaching demonstrations are distinguished by effective use of active learning exercises, ability to accommodate a variety of learning styles, and, most importantly, ability to engage the class.

If you mention active learning as an important part of your teaching philosophy statement, it is important that you use active-learning in your teaching demonstration.

> One time, a candidate had an impressive statement of teaching philosophy that talked about employing state-of-the-art pedagogies, and then failed to use any active learning in the teaching demonstration. I found this particularly frustrating because it suggested an inability to recognize what good teaching/learning is.

If you are using electronic devices, such as clickers, however, make sure you are well versed in how they work before you use them for a job interview. If at all possible, take the opportunity to try them out in the room you will use for your teaching demonstration. Failing technology can doom a teaching demonstration, so either confirm all parts of the system are in working order or go with a technique that does not require technology, such as having audience members raise their hands.

> If one tries to use methods or tools they are uncomfortable or unaccustomed to using merely to try to impress the committee, it will show, and work against them.

Practice! Just as you practice your research talk in front of peers, present your teaching demonstration to colleagues, especially lecturers and other faculty whose primary focus is on teaching. Seasoned teachers have a wealth of experience and information that can ensure that your teaching session is organized in a way that is accessible to students, accurate, and effective at helping students learn. If possible, also practice your talk in front of students at your home institution. Students are quite honest and direct about what they think makes effective teaching and can give your teaching demonstration a true test run.

When you give a practice talk, fully try out any active-learning strategies.

> Candidates we have interviewed recently used standard, lecture-only teaching style and did not engage the audience except in brief, half-hearted, incompletely conceived question/discussion interludes.

This mistake is avoidable. Practicing active-learning strategies will give you an idea of the range of responses you can expect from the audience and help you plan how to react. It is also important to set aside enough time for each active-learning activity. Job candidates often cut short their learning activity with the missive "in a real class I would give the students more time but I am cutting it short today due to time." Be cautious about saying this, because such a statement may indicate poor time-management or an inability to implement the activity.

CONCLUSIONS

Above all, realize that departments want to hire someone who has the potential to be successful in the classroom. While success in research will be measured by your number of grants and publications, success in the classroom will be measured by how well you engage students in meaningful learning.

> The outstanding demonstration of teaching helps us understand how the individual connects with students.

So, among all the things you are doing to prepare for your future career, capitalize on your teaching assignments and mentorship opportunities in your laboratory. Each of these endeavors offers the opportunity to learn how to interact effectively with students. Understanding student concerns and how to help students learn could be the key to landing your academic job.

ACKNOWLEDGMENTS

M.S. is supported in part by the National Science Foundation under grant 0962805. We thank the faculty who responded to this survey. Approval to evaluate faculty responses to survey questions (exempt status, protocol no. 2012-04-07) was granted by the institutional review board at the University of Maine.

REFERENCES

American Association for the Advancement of Science (2010). Vision and Change: A Call to Action, Washington, DC.

Anderson WA *et al.* (2011). Changing the culture of science education at research universities. Science *331*, 152–153.

Bonwell CC, Eison JA (1991). Active Learning: Creating Excitement in the Classroom. www.ydae.purdue.edu/lct/hbcu/documents/Active_Learning_Creating_Excitement_in_the_Classroom.pdf (accessed 20 January 2013).

Bransford J, Brown AL, Cocking RR (eds.) (2000). How People Learn: Brain, Mind, Experience, and School, Washington, DC: National Academies Press.

Coil D, Wenderoth MP, Cunningham M, Dirks C (2010). Teaching the process of science: faculty perceptions and an effective methodology. CBE Life Sci Educ *9*, 524–535.

deWinstanley PA, Bjork RA (2002). Successful lecturing: presenting information in ways that engage effective processing. New Dir Teach Learn *89*, 19–31.

Feldon DF, Peugh J, Timmerman BE, Maher M, Hurst M, Gilmore J, Strickland D (2011). Graduate students' teaching experiences improve their methodological research skills. Science *333*, 1037–1039.

Handelsman JS, Miller MS, Pfund C (2006). Scientific Teaching, New York: Freeman.

Knight JK, Wood WB (2005). Teaching more by lecturing less. Cell Biol Educ *4*, 298–310.

Miller GA (1956). The magic number seven plus or minus two: some limits on our capacity to process information. Psychol Rev *63*, 81–97.

National Research Council (NRC) (2000). Inquiry and the National Science Education Standards: A Guide for Teaching and Learning, Washington, DC: National Academies Press.

NRC (2003). BIO2010: Transforming Undergraduate Education for Future Research Biologists, Washington, DC: National Academies Press.

Ruiz-Primo MA, Briggs D, Iverson H, Talbot R, Shepard LA (2011). Impact of undergraduate science course innovations on learning. Science *331*, 1269–1270.

Shulman L (1986). Those who understand: knowledge growth in teaching. Educ Res *15*, 4–14.

Sweller J (1994). Cognitive load theory, learning difficulty, and instructional design. Learn Instruct *4*, 295–312.