# Chapter 4
# From Learning to Teaching: Bridging Students' Experience and Teachers' Expectations

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## 4.1 Introduction

Teaching entails a life-long learning process. Some people are naturally gifted orators and teachers, while others need to learn how to deliver a lesson in an effective way. Whatever the background, skills, and personalities, teachers ideally never stop learning from their experiences and improving their teaching styles over time. This is becoming easier for instructors thanks to available publications on teaching methodologies, blogs, websites, and the increased number of technological resources available in class.

Today, the view of learning as a passive process is becoming less common among teachers and in university programs. New more active and interactive teaching methods are flourishing, increasing the learning opportunities for students. For example, methods such as project-based learning (Thomas 2000; Helle et al. 2006) and problem-based learning (Hung et al. 2008) are based on different theories such as constructivism (Fosnot 1996; Staver 1998) and student-centered approach (Burrowes 2003). While opportunities for students are increasing, teachers are challenged with extra workloads. Moreover, teachers may use a wide array of different teaching strategies and methods, which can only be implemented successfully if they know how to use these strategies effectively.

Teaching science comes with a specific set of challenges. Scientific methodology is not a part of a novice student's daily life, and introductory biology classes usually include the memorization of a vast technical vocabulary (Leonard et al. 2001).

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C. L. Quave (ed.), *Innovative Strategies for Teaching in the Plant Sciences*,
DOI 10.1007/978-1-4939-0422-8_4, 

Some concepts are complex and require backgrounds in other disciplines (e.g., explaining photosynthesis requires basic understanding of chemistry and physics). Moreover, students in urban environments do not always have the opportunity to observe natural phenomena and processes in their surroundings and thus might have difficulties in imagining concepts explained in the classroom (e.g., it may be difficult to explain to students what humus is and to describe the smell of the humus on the ground of a forest if they have never walked in a woodland).

Instructors develop their ideas about teaching based on personal experiences as students as well as on preconceived notions (Kroll 2004). The amount of previous practice as teachers is also important, as well as other factors such as international experience with different cultural backgrounds and settings and exposure to different languages and customs. Former training in other and diverse disciplines can also affect teaching style, especially if those disciplines are related to education, sociology, or psychology.

In this chapter, we will talk about our personal teaching and learning processes and challenges. Based on our experience, we will discuss why we consider it important to remember your life on the other side of the desk and never forget the problems faced in learning, dealing with class assignments, pre-exam stress, etc. We believe that our main goal as instructors is to deliver knowledge and skills, which hopefully will remain with students long after the conclusion of a course.

We will also discuss how we are trying to use our experiences to make complex subjects interesting to our own students today, since we have both recently started to teach botany, ethnobotany, and bioarcheology. The focus will be on the incorporation of (ethno)botanical concepts in lessons, and related practical experiences in classroom settings. Different plant uses can tie everyday life of students to physiology or anatomy of plants, as well as illuminate past cultures and connect these to modern cultures. We hope that this transdisciplinary approach will help potential educators in their journey to prepare and execute successful lesson plans. We also hope that this chapter will help educators in reaching their students more effectively through recognition of the different backgrounds and perspectives of students.

## 4.2 From Learning to Teaching

Our own experience as students has modeled our attitude as teachers. We have been sitting in classrooms trying to learn concepts related to plants and humans that were tedious at times and simply fascinating at other times. Here we will describe some of our most memorable learning experiences and discuss how they have affected our teaching approach.

### *4.2.1 Our Experiences as Students*

#### 4.2.1.1 Positive Experiences: Baby Steps

Many young students do not like math, and this dislike can last until maturity. To some degree, it seems fashionable to be "bad at math." My earliest experience with a teacher who explicitly put effort into teaching a difficult subject was my fifth-grade math teacher. He was a students, middle-aged man who obviously enjoyed what he was teaching. Like many other students my age at that time, I was bad at math, barely passing my elementary math class. While I had good grades in other classes, math was not my forte.

This teacher started his class explaining to us that, while math can be tricky, it is not as hard as people imagine. He told us that we would learn in small steps that would let us understand the big picture, as well as specific mathematical concepts. He did just that, planning the class in a way that would teach one step at a time and it worked. The class average rose from a low C to a solid B (within a grade system where A is the maximum and F is a fail). For once, math was not the hardest, most hated class. The teacher was and remained a class favorite.

Even today, he is one of the teachers that I would consider pivotal not just to my academic career, but to my understanding of teaching and learning. Later in university, the best teachers were engulfed in their subject but still had the ability to "walk" us through the details. This ability requires detailed knowledge and passion for a subject, but for me as a student it is well worth it and less scary than being thrown in at the deep end. I guess that the same happened back in fifth grade.

A second strategy that has helped me learn is "hands-on teaching." Giving students the opportunity to touch and do their own "research" is an incredibly powerful way of teaching. Even "boring" or "complex" subjects become interesting when they can be applied. Standing ankle deep in a local river to count fauna, observe the flora, and measure the water quality has more of an impact than any picture seen on an overhead. I would argue that this is at least as much, or even more, true in the current times, when students take notes on computers and have the Internet available all the time. "Hands-on teaching" also gives students the opportunity to engage with their peers and teachers, a very different dynamic than the rather one-directional instruction in a normal classroom. This approach is supported by a large body of research (e.g., Hartman et al. 2000; Eick and Reed 2002). Traditional lectures have their merit and are probably not completely replaceable any time soon, but the attitude that the instructors bring to the class, their approach to a class and offering alternative methods (e.g., active research, project groups to prepare presentations) are a good way to open the material to those students who may get lost in a traditional teaching atmosphere.

#### 4.2.1.2 Positive Experiences: Indiana Jones

I have always had a strong curiosity about topics related to ecology and biology. Since I was a child, I have been surrounded by nature, and loved to explore tree canopies and observe the small animals and creatures under stones or in ponds. When I had to decide upon my university track, I chose biology without any hesitation. Sitting in a class, however, was not as interesting as expected and not as fun as walking in a woodland. This was especially true for my undergraduate courses.

The majority of classes during my undergraduate experience were lecture based, with the exception of a few laboratory classes. While one of my favorite professors did not have a different teaching strategy (his classes were frontal), he did have a different teaching "attitude." Above all, he was passionate in what he was teaching. Other teachers were interesting, but it was akin to watching documentaries, while sitting in his class and listening to him was like watching an Indiana Jones movie. He was fun and interesting, enriching his classes by using examples from his past experiences and adventures in the field. I enjoyed his classes, even if the topic he was teaching was not my favorite.

The second positive experience has been very powerful for many reasons. I have never learned so much in such a short time. First of all, it was the first time that lessons were not lecture based, and students were engaged in discussions, while the instructor just kept the discussion within the proper boundaries. My first reaction, I should admit, was skeptical; this approach was just so strange to me. Then, I started to really enjoy this new learning/teaching method. I also started to think and reflect about what I was learning, no longer only absorbing information. In that moment, I realized that there were different ways to learn and that learning could be fun, challenging, and incredibly interesting.

This class was unconventional to me also for other reasons. During the course, there were many practical experiences that involved not only visual and manual practices, but also tasting experiences. The involvement of different senses in the learning process, at least in my case, was extremely powerful and incisive. In my personal experience, I rarely had difficulties understanding concepts, but memorizing them has always been tricky for me. It took me some time to understand why. I can easily memorize pictures and numbers, and I have a selective attention. I had to really put a lot of effort into learning in lecture-based classes, but I still have vivid memories of almost every single class in that course.

Finally, the concepts taught in this course were always bridged to other topics. I have always been amazed by and interested in how things can be interconnected. Moreover, I found it easier to memorize concepts if they were tied to facts that I already know, and especially if I could find connections about these notions across disciplines (see Seifert et al. 1986). I believe that this approach is valuable, especially for the student. The teacher teaches his/her own discipline and, at the same time, he/she is facilitating the memorization of concepts (reducing the homework load) and expanding the worldview and conceptualization skills of students.

#### 4.2.1.3 Negative Experiences: Unengaging Classes

Our negative experiences shared a common feature; classes were boring mainly because instructors were unable or unwilling to engage students. One of the main problems in universities is that often teaching is still seen as a passive process where students can obtain their degree without questioning and by absorbing the delivered knowledge (Thijssen et al. 2002). If information is the only thing that matters, there is no motivation for students to sit in a class if they could get the same information from textbooks.

It has long been documented that students have different preferences for learning styles (James and Gardner 1995; Miller 2001; Pashler et al. 2008). Students have different attitudes, skills, and backgrounds resulting in different performances that vary according to the different strategies in memorizing and learning. Moreover, students have different and personal preferences for the various topics. All of these factors could affect students' preferences and opinions about their teachers. However, there are teaching approaches that are considered consistently negative and some widely appreciated by students. Instructors we found interesting might not have been interesting to other students. Conversely, we may dislike instructors that other people appreciated for certain traits.

We both had a negative experience with an introductory course at university. Introductory classes generally are intended to deliver a huge amount of information that creates the background for the following courses. Looking back, the main problem was that the instructor lectured the material without creating context and without making it relevant to the topic or to us (as students). At that time, the concepts were so decontextualized that we were not able to perceive their importance. These concepts became relevant only after a few years and in more advanced courses. However, the information only became clearly relevant because we continued taking classes despite our initial disappointment. For students who drop out of school or from the specific stream in the first year, these concepts will always remain foreign and will never be useful for their personal and academic growth. The fact that the amount of information in these classes is vast and that students are new to the university system make these courses rather challenging for instructors as well.

### *4.2.2 In Transition: From Learner to Teacher*

When we started to think about our past experiences, we realized that we had several common opinions, observations, and ideas. This is rather curious since we had quite different backgrounds (personal, cultural, and social, not to mention academic). However, we also wondered if we had somehow different attitudes in common as students to begin with, since we both would move on to graduate school and eventually work in academia. We started to think about what makes students decide among the different paths for their future careers.

Several factors may affect the decisions of a student about his/her university and learning track. There is a vast amount of literature analyzing and modeling these factors (e.g., Johnson 2000; McKenzie and Schweitzer 2001; Nora et al. 2005). These factors span from very personal motivations and experiences to culture, religion, economical issues, etc. In our specific case, our motivation was that we both liked learning and enjoyed challenges. At university, we endured despite obstacles and difficulties with the introductory classes.

Generally, students withdraw from higher education during the first year of college (e.g., Pitkethly and Prosser 2001). Sometimes, first-year students are still mentally in high school and may have to get used to becoming more independent. In some cases, students pick a class or topic without having an in-depth plan or idea of their future goal ("It sounded like fun" or "It was the first interesting subject in the course list" or "I saw it on TV"). If instructors are not able to engage students, they will drop out and may not come back to become senior students. On the other hand, senior students generally have already pondered and persisted in their learning process and have invested in their education. These students either have or have developed an autonomous curiosity for the subject and for learning in general. These differences should be considered by instructors when planning an introductory or advanced course. Fortunately, experienced professors can tell new faculty that an instructor can only influence a fraction of students. There will always be students who do well, and a small amount that will be less successful independently from factors such as the enthusiasm and ability of the instructor.

Since we were students, a lot has changed in academia. Instructors and universities have embraced new teaching philosophies and incorporated and applied creative teaching methods in their courses and classes. New technologies and resources are much more easily available to students, and these have been increasing at a very fast pace lately (Smith et al. 2009). Instructors in this era of transition may have several difficulties in trying to incorporate technologies that they themselves were not trained to use (in school) or adhere to new teaching methods that they have never experienced.

Ideally, universities should prepare students to face a rapidly changing environment. Educators can, to a certain degree, prepare students to adapt to new job situations, multicultural settings, and technological changes by sparking their curiosity and encouraging them to become lifelong learners (Brown 2002). We (as educators) need to learn from both the positive and negative models we have experienced in the past, learn new teaching methods and approaches, incorporate new technologies, and integrate students' needs into our courses.

## 4.3 Applying Experience as Students to Teaching

Based on our experience as students, we have selected three main features and "lessons" that seem to be recurrent in our stories.

### 4.3.1 Small Steps: How to Balance Student Engagement with the Delivery of Essential Information

Defining the fundamental content of your course before starting is essential. If you want students to learn 20 main concepts, teach them these concepts instead of teaching everything you know hoping that students will, at least, remember these main concepts. After being a university student for more than 10 years, it can be difficult not trying to share everything that you know about a topic. We learned that we had the best grades and best performances during oral exams if we were talking a lot. The first teaching year comes with the perils of feeling judged and the need to impress. The first instinct is to over-share all of your knowledge because you want to give the impression that you are well informed and a good teacher, but sometimes also because you are full of enthusiasm. After becoming an "expert" in a subject everything seems relevant and your excitement may lead to teaching too many facts that a student cannot follow. The dramatic result is usually a convulsive lecture full of information. It may take some time to understand that these sorts of lectures are the ones that we classified as boring when we were students.

Learning the art of synthesis is a main goal at the beginning of the career of an instructor. Just like learning to communicate information in journal articles, communicating a balanced amount of information to an undergraduate audience needs to be learned. Too much information can overwhelm the student and hinder inspiration and enthusiasm. We also have to remember that for some of the students in class, this might be the only opportunity that they will have to learn about botany, ethnobotany, or bioarcheology. Especially for these students, it is more important for them to understand and learn a few concepts rather than have a vague idea about many concepts. The ability to communicate clearly and concisely is not just necessary in the classroom but in general. Very few people are specialists in the same field, so we will be dealing with nonexperts on a daily basis. It is important for students, whatever their future field of expertise, to learn some basics that can help them to be more critical in the future (and notice discrepancies in news articles, documentaries, or museum exhibitions). Perhaps, some of them will even be excited enough to take an additional class.

Students taking botany classes have to learn specific terms that are important for understanding core concepts and taxonomy. However, they need to learn them progressively. Botany teachers should avoid presentations full of information and technical terms. As experts, we tend to use technical terms on a daily basis and might have a different perception of what is a difficult term or concept. In other cases, we may just believe that if students learn the basics of botany at the beginning, they will be able to appreciate the beauty of the following more complex botanical topics.

Again, everything feels important in the beginning. However, students do not need the full wealth of technical terms to understand concepts or explain complex processes. What is more important is to explain to students how they can look for information (if they want to enlarge their perspective on specific concepts) and how

they can critically select the most relevant sources. Students also need to learn how to deal with difficulties (e.g., a boring class) and to continue despite initial failure (Schwartz 2008).

### 4.3.2 Hands-on Learning

Learning the theory is one thing, but being able to apply and test it out is another. You do not learn to drive a car by simply learning the theory; you need to get into the driver's seat and practice. Finding ways to provide students with some practical applied experience can be challenging but rewarding. Practical experiences, according to our experience, are generally well accepted by students. Thus, it is not surprising that we both had positive memories about hands-on experiences.

There is a wide wealth of papers discussing the efficacy of different hands-on teaching strategies (spanning from journal writing to field experiences; e.g., Fink 2003; Sliško and Planinšič 2010; Jara et al. 2011). While hands-on learning can be an important tool to foster the learning process, it is equally important to carefully plan these exercises based on the ability of the student (e.g., Ford 1978; Svinicka and Dixon 1987). For example, more novice students can practice concepts and newly learned plant morphology by collecting plants in their own backyard or kitchen-gardens and identifying and comparing them in class. In subsequent lectures, this activity can be used to compare the modern ecosystem to past ecosystems, discussing changes of species diversity and climate over time. More advanced students can plan and prepare mock research proposals, integrating basic knowledge with newly gained insights into the latest advances in the field. In addition, they can have the opportunity to think through a potential research project and learn about scientific methodology. In order to foster the understanding of relevant information of a film shown in class, a worksheet with a set of questions might enhance the learning experience as well, shifting the teaching segment to a more active participation.

### 4.3.3 Making Topics Interesting

Information is remembered better when made relevant to the learner. This could be difficult in introductory classes, as specific concepts need to be contextualized both within the discipline as well as within the student's knowledge and interest base. An understanding in plant anatomy is necessary to succeed in more advanced botany and ethnobotany classes. The reasons for students to know about plant anatomy or plant DNA sequencing should not be limited to the fact that these topics "will be on the exam," but rather because knowledge of these topics will create a foundation for a variety of more advanced topics.

"Difficult" is a relative concept and depends on the learners' experience and background, but also on teachers' ability to deliver information effectively. Students can learn difficult concepts if the course is developed in baby steps, where complex topics are gradually approached. Information should also be meaningful for

students. A good strategy for stimulating students' interest and willingness to learn could be highlighting how specific information might fit within a wider picture. Information could be contextualized in order to become relevant for students' everyday life or their world (e.g., how plant distribution in the past could give us clues about current climate change, the use of food, and medicinal plants today and in the past) and in the specific discipline (e.g., molds and the discovery of antibiotics). For example, archaeology is currently discovering the "Paleo diet" as a vehicle to educate the public about prehistoric people's health and diet and how our lives have changed over the past 10,000 years. This topic can also be used as a starting point to talk about plant domestication (e.g., Warriner 2013) and plants used in modern diets.

## 4.4 Turning Teaching Theory into Teaching Practice… and Experience

University instructors are usually not explicitly trained in pedagogy. We are trained to become researchers, rather than teachers, and many consider themselves researchers before teachers. We have both attended classes focused on teaching in academia. These classes can be very helpful for increasing self-confidence in teaching and for learning about current teaching/learning/approaches and how to apply them into practice. There are several websites, courses, and seminars that provide, to different extents, a background in teaching methods or resources (e.g., the OSN (Open Science Network, http://www.opensciencenetwork.net/) or the internationally known Instructional Skills Workshop (ISW), http://iswnetwork.ca/). However, practice and theory are two different things.

Preparing a lecture, especially for the first time, can be challenging. Our curiosity as researchers may lead to extra research on the topic at hand, finding possible connections and additional examples. While textbooks are helpful as teaching tools, examples provided in the textbook might not fit what the individual instructor needs for clarity or simplicity for the particular class. However, learning how to develop and create modules and lectures is much simpler than managing an entire course. Lecturing constitutes only a small part of workload, which also includes answering questions, finding additional educational material, grading, corresponding with or receiving students; activities that consume a surprising amount of time. Moreover, to stay on top of current scientific findings and theory, teachers need to revise their modules, material, and examples on a regular basis in order to maintain authentic passion and enthusiasm for the course.

A lot of "good teaching" will come with experience. Besides all training courses, preparedness, enthusiasm, and good intentions, only practical experience can give teachers the sense of what teaching really means. For example, courses do not teach you how to deal, emotionally, with disinterest or drop out of students. While it is possible to increase attention of students in class by using alternative strategies, it is not always possible to impede withdrawal from schools. Inexperienced teachers may perceive this as a personal failure, which may reduce the enthusiasm in teaching.

While teaching might be demanding and tiring, it can also be extremely rewarding. When you see a student looking at leaves of a bush while she is waiting for the bus after your class, a student unexpectedly delivering a great presentation, or someone is grateful for your advice, your hard work pays off after all. As much as teaching can be frustrating, wading through beginner's mistakes and paperwork, being able to tell a student that he/she did great is well worth it, especially if these students are not popular or outspoken in the class. Moreover, keeping in mind that not all of the students are trying to cheat or lie to get out of an exam is an important part of positive interactions with the class. Many mistakes are honest mistakes, and students are trying hard to adjust to the new environment of higher education. Experience or advice in the form of anecdotes from more senior faculty members may lead to a less stressful environment for the new instructor that is navigating the perils of student interaction.

## 4.5 Lifelong Learning Teachers

Students today are generally exposed to a large amount of information. When we were students, information was only available in class from teachers or in books, generally in libraries. Researching a topic could have taken several days and many hours of searching for pertinent literature. Today, information is easily available to students, and the search for relevant data could take only minutes to a few hours. Teachers and books are no longer the easiest way to obtain knowledge. The result of this easy "accessibility" is that students have less interest in sitting in a class if they can get the same information faster otherwise (e.g., on the Internet). Instructors need to balance between proven and successful lecture methods and new digital environments to lead the class toward (and through) the material taught.

Teenagers and young adults, and thus college and university students, are accustomed to fast technology and are connected to each other through social networks. Students are constantly exposed to facts, information, concepts, and thoughts. The time one can spend on each piece of information, consequently, has to be minimized; concepts are quickly processed and categorized. While teaching, we have to keep this in mind, keeping students interested in a class for more than 5–10 min can be hard. A variety of strategies can be used for making the content of a class more appealing. One strategy could be switching tasks or mode of teaching every 10–15 min. Other strategies include adding "weird science" (quote from a student) and information that is directly related to the students' life, to the lecture.

Finally, novice students frequently accept information uncritically. Providing space to question and develop critical academic thinking can help students to learn how to argue, defend, and criticize information in discussion and writing equally. Critical thinking might be one of the most important skills one can learn in university. Students will eventually obtain more information about the topic of the course through other sources, but they need dialectic skills (defending and supporting their ideas, questioning the source) when trying to convince other people that we should

save forests instead of logging. For this reason, it is also important to observe students, how they behave and interact with each other, and to be open to questions from students, in order to provide them with what they need most to succeed.

## 4.6 Conclusion

The transition from learning to teaching can be challenging. Some common themes seem to reverberate among students, and thinking about these can help new instructors make better choices and the learning curve less steep. Here, we have identified four suggestions, based on our experience as students and teachers, for newly minted instructors:

1. Enthusiasm is a great attribute to get students engaged.
2. Make concepts accessible by breaking it down into manageable units.
3. Provide practical experiences in the course whenever possible.
4. Contextualize information in a way that is meaningful for students.

Perhaps our suggestions will be considered naive by experienced instructors. With years of teaching, our ideas and ideals will likely change. Yet, this is also an exciting time: our student experience is still relatively fresh while we are already full of ideas and enthusiasm for our new challenges as teachers. Can we create a better learning experience for new students based on this? Can we integrate our experience with our own students' experience and accept that goals and attitudes might be different?

We have learnt a lot about teaching while writing this chapter. The discussions helped us to identify common problems, despite teaching different disciplines. Discussions and exchange of ideas with students, colleagues, and experienced professors are important moments for improving our skills as teachers. This is especially true in a world that is changing at an incredibly rapid pace. Keep learning.

**Acknowledgments** This chapter has been written "with the assistance of the Government of Canada/avec l'appui du gouvernement du Canada." Many thanks are also due to the Hakai Network for Coastal People, Ecosystems, and Management (Simon Fraser University, Burnaby, BC, Canada) and the Tula Foundation (Heriot Bay, BC, Canada).

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