Improving Instructional Fitness Requires Change

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Transmission of information has benefitted from a breathtaking level of innovation and change over the past 20 years; however, instructional methods within colleges and universities have been slow to change. In the article, we present a novel framework to structure conversations that encourage innovation, change, and improvement in our system of higher education, in general, and our system of biology education, specifically. In particular, we propose that a conceptual model based on evolutionary landscapes in which fitness is replaced by educational effectiveness would encourage educational improvement by helping to visualize the multidimensional nature of education and learning, acknowledge the complexity and dynamism of the educational landscape, encourage collaboration, and stimulate experimental thinking about how new approaches and methodology could take various fields associated with learning, to more universal fitness optima. The framework also would encourage development and implementation of new techniques and persistence through less efficient or effective valleys of death.

Keywords: educational landscapes, evolutionary instruction, inclusive teaching, teaching strategies

Arguably, the effective transmission of knowledge and information within and between generations has been the principal driver of society's technological progress (e.g., Diamond 1997). The increasing efficiency by which this knowledge is shared and transmitted has spurred breathtaking technological advances over the past 50 years (e.g., Kurzweil 2005). Despite this amazing rate of change in how we interact with, assimilate, and distribute information, higher educational systems have only recently introduced and tested modest methodological advances to achieve improvements in teaching and learning. At most institutions, lecturing and variants of the Socratic method have been most common in conveying information and helping students attain conceptual understanding. Not that these methods are without merit, but rather, the increase in diversity of approaches to teaching and assessment has been, until recently, frustratingly infrequent and has remained localized.

Several recent educational methodological developments and key assessments have provided substantial evidence to indicate that some newer methods are as good or better at improving learning (Zhao and Kuh 2004, Kuh et al. 2006, Harper and Quaye 2009, Labov et al. 2009, Trowler and Trowler 2010, Kahu 2013, Millard et al. 2013, Freeman et al. 2014, Korhonen et al. 2019), particularly among underrepresented students (Hurtado et al. 2009, Rodenbusch et al. 2016, Estrada et al. 2016, Theobald et al. 2020). On the basis of the evidence, and particularly important given our increasingly pluralistic community of learners, our responsibility should be to consider new approaches and, perhaps more notably, to convince others that they should also adopt or adapt evidence-based methods. The goal of this essay is to help frame these conversations in a different and (perhaps) more useful light. We suspect that our exhortation to start these conversations would be more effective if we adapt an evolutionary visual model that is easily understood by biologists. Providing this framing and visualization will likely help the community in its efforts to engage with colleagues that are interested in changing or disseminating their instructional practices (and data) but, for a variety of reasons, are reluctant to integrate and adopt these evidence-based practices.

Change is beautiful to see but difficult to experience.

Change is difficult, in part, because the process relies on the concealed and complex part of human nature that resists change (Savkar and Lokere 2010, Anderson et al. 2011, Starr 2011). To complicate matters, there are numerous and stacked variables that mostly conspire to keep the status quo. In some cases, the status quo is maintained by obstinate educational institutions that, at times, are unsupportive of changing their business practices that mostly rely on commonly used and scalable instructional practices that yield sufficient margins to allow them to remain financially solvent.

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The existing theory of change literature has developed a rich and increasingly diverse set of cases that provide instructional guidance about how to navigate these (and other) institutional challenges to change college campuses (e.g., Kezar et al. 2015, Grunspan et al. 2018) as well as providing some instructional frameworks that help us understand why faculty and students are resistant to adopting new practices and less motivated to undertake change (e.g., Cavanagh et al. 2016 and Wigfield et al. 2009). Despite these commonsense strategies, recommendations, and guidance about how to institute change, these have generally been ineffective at changing how STEM (science, technology, engineering, and math), in general—and biology, specifically—are taught (Handelsman et al. 2004, Borrego et al. 2010). For example, Stains and colleagues (2018) recently examined nearly 550 faculty as they taught more than 700 courses at 25 institutions in Canada and the United States and discovered that only 18 percent emphasized a student-centered style that focused instructional strategies on group work and discussions. On the whole, most instructors still devoted a large part of their instructional time to instructor-centered strategies, such as lecturing. This resistance to change is also acknowledged by Grunspan and colleagues (2018), who adopted a cultural evolution theory as a lens through which to explore strategies for moving toward active learning.

Resistance to adopting more contemporary approaches to instruction is complicated

Even when there is an interest in changing instructional practices, the learning and instructional dynamics are complicated, the learning curves for faculty are often steep (Brownell and Tanner 2012, Chen and Goller 2019). Even promising instructional innovations commonly result in failure during the critical initial trials, and these failures can often be paired with poor student evaluations. In addition, because assessment data are difficult to gather, it is also often burdensome to ascertain whether new approaches yield any improvements to the students' learning early in the implementation cycle. Moreover, it is also not uncommon for the students to demand that the instructional environment revert to the most comfortable and habituated practices (Malone 2018). This response is unsurprising given that, by the time those students enroll in your course, they have already been successful in courses that use traditional teaching approaches.

More recently, we have better evidence that instructional improvements are affected by several social, psychological, and structural barriers that may complicate our strategies to improve instruction (e.g., Kubler-Ross's (1969) change curve, Elrod and Kezar 2017). These include but are not limited to variation in the students' self-efficacy, motivation by both the students and faculty, the prevalence of microaggressions in the classroom, and a lack of belongingness (Seymour and Hewitt 1997, Estrada et al. 2011, O'Brien et al. 2020 provide a few examples). Structural barriers are similar to the challenges to innovate and change that are present in many other fields (e.g., the classic change curve; Schneider and Goldwasser 1998). Structural barriers could include the resources available to implement the changes, physical or environmental barriers such as space, technology, or even variation in faculty instructional assessment strategies that often complicate success measures of a new strategy (Pollock and Finkelstein 2008).

Consequently, it should be unsurprising that implementing a new (and perhaps more effective) instructional strategy is fraught with many seen and unseen challenges. More to the point, implementing innovative and better instructional techniques is oppressed by logistical and professional risks. (In the present article, by *better*, we mean more effective at improving learning.) If our educational efforts are to improve, we must continue to insist that this tension is addressed through discussion and action. However, because these discussions are often challenging to frame for those of us in the choir who regularly have conversations with undiagnosed doubters, the sales pitch is often entangled in the complexities or, worse yet, not made at all. However, without these critical conversations with peers, administration, and funding partners, it is unlikely that evidence-based instructional strategies would be adopted and scaled, and perhaps more importantly, new strategies would remain untried, unassessed, and unfunded.

Connecting educational and evolutionary landscapes

As a graduate student in the early 1990s, one of us (JH) worked at an institution at which nearly all classrooms had overhead projectors—a useful tool to project acetate transparencies, the technology of its day. Soon after taking his first teaching position, he started using PowerPoint (a newly acquired product in the Microsoft Office Suite). His efficiency (and arguably, his effectiveness) as an instructor improved dramatically. He could make changes on the fly to account for the numerous advancements in biology and he used the emerging technology to show animations and, eventually, embed movies. He sensed that the approach was providing his students a more intuitive understanding of complex and dynamic concepts such as dilutions and the chemiosmotic generation of ATP (adenosine triphosphate). However, migrating his courses over to PowerPoint was not without cost and risk. There were many hours of conveying the concepts in a platform that was new to him, and there were initial challenges with the technology, such as using TIF files previously saved on a Macintosh. This was one of several challenges that instructively interfered with progress through what is often referred to as an innovation curve (Rice and Rodgers 1980, Rogers 2010). More recently, because of the COVID-19 pandemic, many of us have experimented with hybrid or fully online course delivery methods and have invested heavily in processes, tricks and strategies that have varied in their effectiveness, but all required a tremendous amount of time and effort to implement, with initial attempts failing on several fronts. Some of

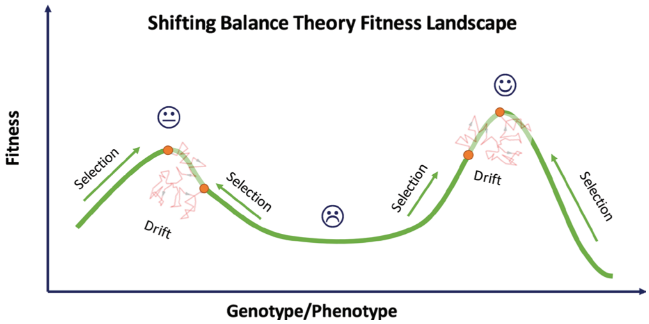

Figure 1. Diagrammatic representation of Sewell Wright's shifting balance theory using selection and mutational drift to reach more universal fitness optima of any one trait.

these burdensome changes and innovations have, arguably, improved the experience for our students and in some cases improved their learning.

The innovation curve has an analog in a simple evolutionary fitness landscape. Fitness landscapes were first proposed by Sewell Wright, a prominent American geneticist, in the early twentieth century (Wright 1931) to frame conversations about evolutionary change. Wright provided an often-cited mathematical model demonstrating how frequencies of alleles and genotypes changed on the basis of evolutionary selection pressures. That is, the model explains how genetic drift and selection are the driving forces that move populations of organisms to local and universal fitness optima. This shifting balance theory is still used today to explain how genetic and phenotypic characteristics of populations can change and adapt to more universal fitness optima (figure 1). In a very similar way, the analogous use of instructional innovations (e.g., PowerPoint) reflects how these instructional innovations can be represented with instructional landscapes. The innovations can be considered disruptional (or "mutational" in Wright's terms) changes that, if successfully adopted, generally improve the effectiveness (fitness) of the educational population in question (figure 2). Not that all these innovations always work; much like mutations, they often do not.

In the mid-1990s, and at many institutions, there were a few faculty who tried PowerPoint and met with disastrous results. In some cases, they had difficulty understanding the fonts, using transitions or animations in their slides, or even saving files in the right file format. The investment of time and energy to develop a more efficient (and perhaps more effective) system to dispense information was too difficult and they reverted to acetate overheads and handouts. They are probably still using them! That is, the process of migrating instructional materials or changing your instructional methodology to convey biological concepts into PowerPoint is difficult and, arguably, can fail to universally improve students' understanding of biological principles in the first few challenging semesters (valley of innovation in figure 2). Even when the change provides evidence to show that the implementation of a new method (e.g., PowerPoint) has led to improved learning over the traditional blackboard, there are scores of techniques that, for one reason or another, have failed to improve learning. They may be too expensive, unscalable, inappropriate for the modality (online learning, as one example), or too complex. Or, importantly, they may not be equally effective for all disciplines, individuals, or educational levels.

The fact that our educational community has resisted change for many years suggests that we are in a particularly isolated and localized optimum. Like Eric Mazur's experience (Mazur 2009), there are still many of us who still happily, "successfully" (and exclusively) lecture. Despite our knowledge of learning, the students' test scores—and their opinion of the instructor's instructional quality—remained high.

Overcoming the valley of innovation or "valley of death" (as some innovation and change experts refer to this stage; Elrod and Tippett 2002) reflects some of the difficulty in changing instructional practices among the current scientific community. Not that we have not changed, but rather, change has been difficult and incremental, and in many cases, the failures provide even more "evidence" that we should have stood pat. Lecturing has existed for over 600 years in the classroom, and in this light, it is somewhat understandable why this practice has, largely, not evolved. Not unlike Wright's two-dimensional fitness landscape, the curve that characterizes the change dynamics can vary depending on the institution, faculty member, departmental culture and student population served (other common variables are described at the bottom of figure 3). In short, the curve is strongly influenced by the educational environment and is unlikely to be identical at different institutions, departments, or for individual faculty.

In other words—like evolutionary landscapes—educational landscapes are multidimensional, dynamic, and context dependent (figure 3). Reaching even a localized optimum in the educational landscape is complicated and requires iterative assessment and adaptation. PowerPoint is only one of many examples of localized instructional optima where many of us spend a great portion of our careers. Perhaps, and in hindsight, JH would have been better off investing much of his energy to develop his research program with the assistance of undergraduate collaborators within his classroom. Unfortunately, this epiphany did not emerge until many of us struggled with teaching a full load at a primarily undergraduate institution at which there were still expectations for scholarly productivity to earn tenure. It would have been more efficient and effective to experiment with what are now known as course-based undergraduate research experiences (CUREs; table 1) earlier in our careers. Not that the technique did not exist, but rather, that many of us did not know CUREs existed. It was this blind spot that allowed us to wallow in our localized optima until much later in our careers.

Discovery of these more universal optima will *require* our individual and collective efforts to try, assess and disseminate new techniques as they emerge in order to accelerate

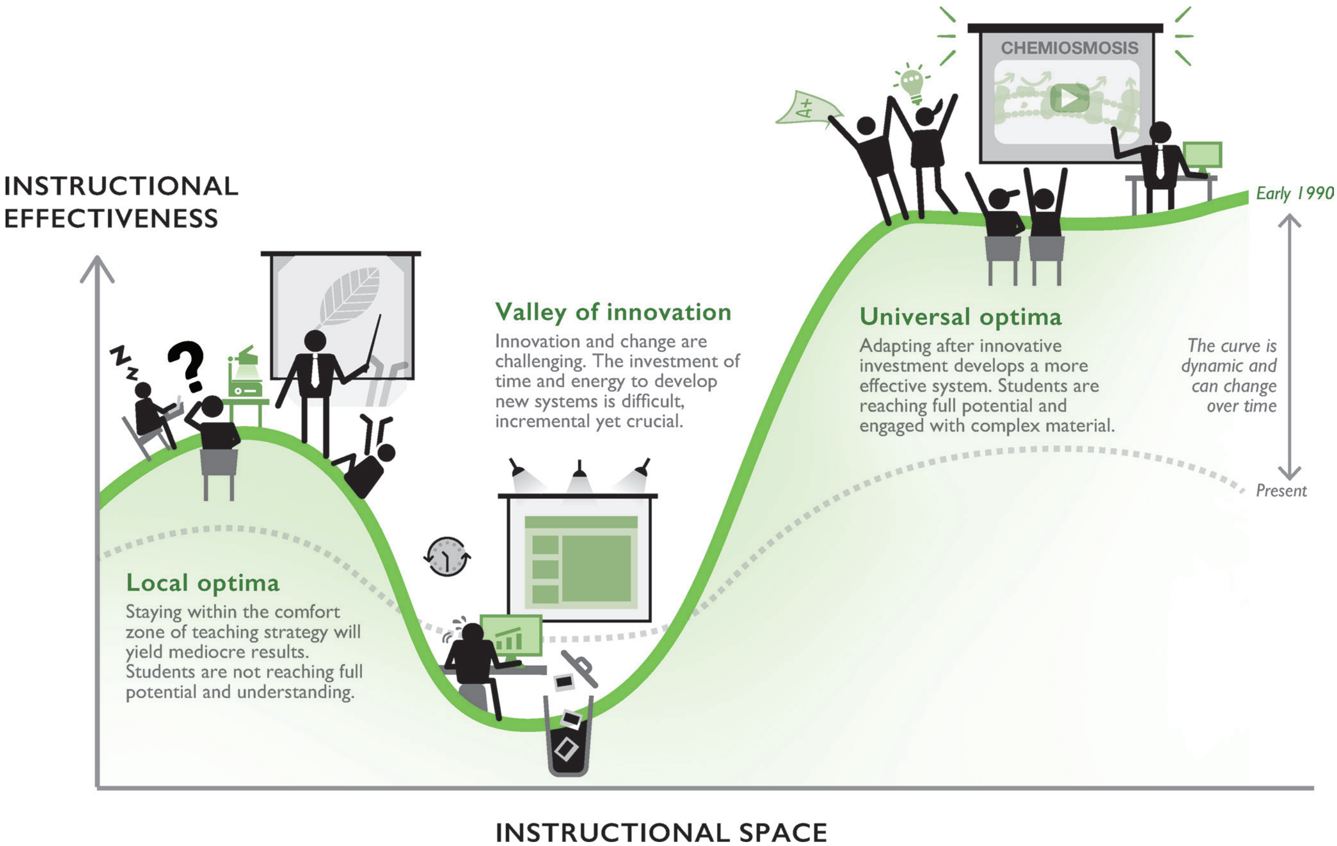

Figure 2. Schematic and hypothetical representation of the instructional improvements using PowerPoint. In this instructive example using two-dimensional instructional space, instructional effectiveness could be theoretically improved by transitioning from using overhead projectors to PowerPoint. The example highlights how educational innovation can transform instructional practices toward a more universal optimum. The dotted line represents a hypothetical change in the two-dimensional landscape over time.

the adoption of best practices in our scientific learning environments. It is a requirement because these educational landscapes are always changing—sometimes unexpectedly and dramatically, as our recent educational responses to COVID-19 have demonstrated. What we teach, who we teach, and even where we teach is dynamic and many unanticipated valleys will provide new challenges to the next generation of biology teachers seeking to improve learning. The point being that, as with science, learning environments are filled with continuously emerging developments and changing theories. Given these changes to our environment, we need to iteratively consider and assess how we teach. This experimental and evidence-based approach to teaching (often referred to as *scientific teaching*; Handelsman et al. 2004) will help us adapt to emerging challenges that limit learning by our students.

Overview of effective strategies

Scientific teaching takes a rigorous, evidence-based approach to teaching and learning as expected in science (Handelsman et al. 2004, Wenderoth 2007, Couch et al. 2015). Although there has been recent interest in scientific teaching, the idea of using scientific principles in our educational endeavors has been around much longer (e.g., Hart 1916). The three core pillars of scientific teaching are active learning, assessment, and diversity. As the name suggests active learning involves an array of high-impact teaching methods that could be used in creating a classroom environment in which all students are engaged in the learning process. As is common in science, the effectiveness of an approach is measured through assessment of experimental results. In scientific teaching, a similar approach is taken to assess the effectiveness of these teaching methods (Angelo and Cross 1993). As we mentioned earlier, active learning methods in combination with the appropriate assessments are effective in engaging a diverse group of learners. This approach is helpful in promoting the success of students who are typically underrepresented in the STEM disciplines. Even though scientific teaching strategies have been shown to be effective for student learning, these approaches have not been adopted at scale.

Inclusive teaching is one of the emerging developments among our community of science teachers and researchers. Inclusive teaching is the notion that psychosocial factors strongly influence the likelihood that all students learn. Although many of our biological brethren have recently

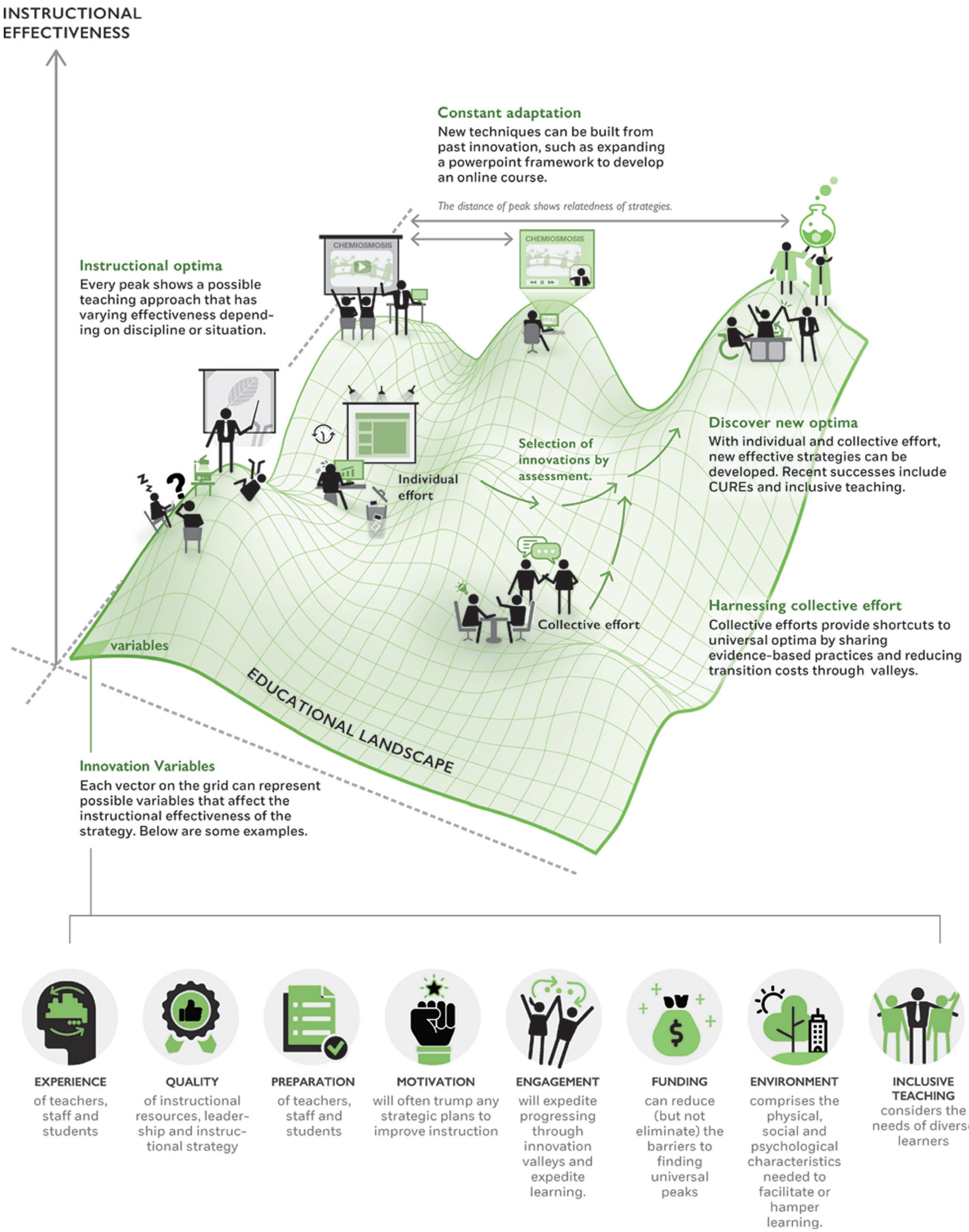

Figure 3. Representation of a more complicated three-dimensional educational landscape extrapolating from the information on Figure 2. Instructional optima showing hypothetical teaching approaches with varying levels of effectiveness depending on discipline, environment and multiple other variables. This educational landscape, similar to evolutionary landscapes, is multivector, complex and dynamic depending on what, who, when, and where we teach.

Table 1. Common and contemporary examples of instructional approaches or techniques that are aligned and compatible with inclusive and scientific teaching principles.

Method or Technique	Brief description
Case Studies	offer powerful way to bring context into the classroom and make content relevant for students. This method allows the teacher to work with the students in understanding the facts and immersing themselves in a deeper analysis of the problem and consider possible solutions and consequences for their actions (Herreid 1994). Using case-studies was found to increase student engagement in the classroom as cases provided the students with the context to understand scientific ideas (Cloud-Hansen et al. 2008, Knight et al. 2008). The National Center for Case Study Teaching in Science offers a collection of case study resources (https://sciencecases.lib.buffalo.edu/).
Course-Based Undergraduate Research Experiences (CUREs)	are research-based courses or course units, in which all students participate in undergraduate research. CUREs present a different model from the traditional mentee seeking out a mentor to pursue undergraduate research and may be particularly effective in laboratory courses. The students actively contribute to various aspects of a larger research program that is usually aligned with the instructor's expertise and valued by the scientific community. CUREs reduce the barrier for the student having to seek out research opportunities and expose the students to how scientists in a discipline approach problem-solving at the highest level. Two key elements that separate CUREs from other pedagogies is the opportunity given to the student to iterate and improve on their approach and the methods that aim to contribute to peer-reviewed scholarly products, usually a paper or a meeting presentation (Bangera and Brownell 2014, Corwin et al. 2015).
Inquiry-based learning	is an active learning pedagogy in which the learner engages with the material through posing questions, problems or scenarios and engaging as well as investigating and collaborating to make meaning (Bell et al. 2010, Dostál 2015). Inquiry can be classified into four types: Confirmation inquiry (Level 1), Structured inquiry (Level 2), Guided Inquiry (Level 3), Open inquiry (Level 4; Yoon et al. 2012). Inquiry-based learning is extremely important for developing higher order thinking skills such as the ability to analyze, synthesize, and evaluate information.
Modeling in biology	is a complex set of methods which are an integral part of the authentic scientific inquiry, and its purpose can be one or more of the following: to describe complex phenomena, represent core ideas about a system, be manipulated to explore the dynamics of a system, be used to make predictions about future events, suggest the need for empirical studies, and facilitate the communication of ideas. Chiel et. al (2010) have presented a nice description on the history of modelling in biology and a summary of tools one could use to implement modeling in a biology classroom. Thus, modeling as a teaching tool can be effective in students not only being able to understand scientific concepts but also helping them develop more sophisticated ideas about the process of science (Svoboda and Passmore 2013).
Peer-instruction and Peer-Led Team Learning (PLTL)	are approaches where students in a class learn from other students. In the PLTL model, students who have taken the course and done well in the course serve as peer-leaders to help the students taking the class. In the PLTL model the peer-leaders typically lead a workshop with the students outside of the class time in the absence of the instructor. Peer-instruction includes a much broader class of instructional strategies where students in a course with similar levels of expertise learn from each other. Peers also can serve as learning assistants or tutors, roles where they are responsible for helping other students with the material. These peer-led approaches have been shown to be effective in providing opportunities for students of varying gender, ethnicities, and socio-economic status to serve as role models for students and provides a transformative career experiences that can enhance their sense of belonging in STEM and their science self-efficacy (Mazur 1996, Gosser et al. 2001, Mazur 2009, Wilson and Varma-Nelson 2016).
Process oriented guided inquiry learning (POGIL)	is a student-centered interactive process of refining understanding and developing skills to work in a team as a part of the learning process. Students work in small, self-managed teams on specially designed guided inquiry materials, while the instructor only plays the role of a facilitator (Farrell et al. 1999, Walker and Warfa 2017).
Project based learning (PBL)	is a pedagogy where deep learning happens through students attempting to solve complex real-world problems by collecting or analyzing data, engaging in discussions, designing plans or experiments, making predictions drawing conclusions and communicating ideas (Blumenfeld et al.1991, Gordon 1998, Bereiter and Scardamalia 2000). Project based learning is different from CUREs in that the capacious problems that the students tackle can be new to students, but they do not have to be new to the scientific community.

contemplated, and in some cases addressed, the psychosocial variables in their instructional practices, our colleagues in the social sciences have understood and have contributed to the growing body of literature since the 1930s (e.g., Bowden and Melbo 1937). We are only now—as biologists—gaining a better understanding of the importance and value of inclusiveness in our classrooms (Williams et al. 2005, McDermott and Mack 2014). Given the mounds of data from our colleagues in the social sciences, and increasingly from biologists collaborating with social scientists (e.g., Findley-Van Nostrand and Pollenz 2017), we would do right by our students to undertake a critical examination of what has been shown to work.

Inclusive teaching promotes equal access to learning through instructional practices that consider students' diverse perspectives, varied academic experiences, personalities, and range of backgrounds (Sathy and Hogan 2019). Methods of inclusive teaching address achievement gaps by promoting a sense of belonging in the classroom, using diverse modes of active class instruction, engaging in a structured teaching style and using student success data to ensure that all types of students benefit in your class (and making adjustments when evidence reveals achievement gaps; Tanner 2013, Dewsbury and Brame 2019, Sathy and Hogan 2019).

Although it may be difficult for science faculty to envision inclusive teaching practices in content heavy courses, many inclusive practices require simple instructional adjustments. A few practical tips from experts in STEM inclusive teaching (Tanner 2013, Sathy and Hogan 2019) are described below. Dewsbury and Brame (2019) described a more theoretical framework of inclusive teaching and long-term shifts in instructional mindset and practices.

Connect with students: Promote a sense of belonging and facilitate learning by using student names often, making an effort to interact with students who are reluctant to engage, and using examples in class that are relevant and interesting for all types of students in your course.

Set clear expectations: Take out the guesswork for students by clearly communicating daily objectives and ensuring that test questions align with those objectives; be clear about how students will be graded, for example, by sharing grading rubrics in advance.

Increase wait time: Increasing wait time after posing a question and providing the opportunity for all students to answer, either on note cards or through polling software, gives everyone the chance to understand the question and reflect on their responses.

Ask for student feedback: At minimum, at the beginning, middle, and end of semester; formulate questions to gauge students' sense of belonging in your class and what you could be doing differently to facilitate inclusiveness. An example of this is the minute paper (a technique by which instructors ask students to respond briefly—in 1 or 2 minutes—to a prompt or question that, frequently, challenges student to write a synopsis of what they have learned or provide feedback about the classroom environment; Angelo and Cross 1993).

To most of us, the field of inclusive teaching represents a new horizon of the educational landscape that is worthy of additional study and consideration.

Table 1 has a brief description of the more common (and comparatively recent) instructional approaches and techniques that may inspire us to improve learning in our courses. In addition, an excellent review of some of the common terms and methods encountered in the field of biology education have been nicely summarized by Miller and Tanner (2015) and information embedded within the American Association for the Advancement of Science's Vision and Change Report (AAAS 2011). Many of these approaches are very aligned and compatible with inclusive and scientific teaching principles.

Structuring conversations with resistant faculty

By now you are probably wondering how to use the model to start a discussion, and more importantly, how to use the model to frame conversations with resistant faculty. To start, there may be no better timing. Although there are few educational benefits to the COVID-19 pandemic, the educational disruption that has followed the social and medical calamity has forced us to rethink how knowledge is generated and shared. The events have made many of us more receptive to reimagining learning and how different elements of teaching affect instructional effectiveness. Said another way, we are ripe for convincing that our instructional strategies need to be examined, assessed and changed.

Most biologists understand fitness landscapes and are likely to agree that different variables have an impact on the effectiveness of instruction. Some (but not all) of these variables are briefly described at the bottom of figure 3. For example, nearly all teachers would agree that instructional effectiveness is linearly related to motivation but this relationship (and the curve that describes the relationship) is strongly influenced by many other variables. Student and faculty motivation may be important, but its effect may be tempered when both are working in a classroom that lacks inclusiveness, or heat. In fact, the relationship between motivation and instructional effectiveness likely is also affected by funding, availability of technology, availability of mentors, and so on. The multifaceted nature of the landscape (as with evolutionary landscapes) make for a complex and dynamic laboratory in which new ideas and theories can be tested about how, when, and why students learn.

Therefore, it may be instructive to take a two-dimensional graph (e.g., figure 2) and ask colleagues to draw how instructional effectiveness would look if you replaced PowerPoint with, say, the proportion of learning taking place by Zoom. Once comfortable with the exercise, it would not be too implausible to ask how motivation, administrative support, or the use of CUREs might affect the fitness curves. After establishing that there are some differences of opinion, the visual models provides a wonderful opportunity to discuss educational experiments at your institution that would address the tension. Most scientists would relish the opportunity to test out ideas and, we suspect that these conversations would open the door to address more complicated subjects about experimentally addressing institution- or departmental-specific variables. By using the visual model you can explain to resistant faculty—for instance, why it is that the first semester of their CURE was a disaster without ceding the more important and aspirational goal of iteratively overcoming the valleys of death to reach a more global instructional optima. Moreover, the COVID-19 disruption has provided us with the resurfaced landscape that will place many of us in instructional effectiveness valleys that require different approaches to learning. There is motivation by your colleagues to change. It is up to us to collectively and scientifically innovate, assess, and iterate instructional methods that work for all our students. The change starts with a conversation.

Conclusions

We develop a framework that borrows from a classic biological model of the fitness landscape, to newly visualize the multidimensional nature of education and learning. We hope this framework will motivate educators to appreciate the complexity and dynamism of the educational landscape, including ferreting out synergies among innovations in teaching that could enable rapid improvements to new instructional fitness peaks. With our visual model for improving learning practices, we aim to foster constructive conversations around teaching methodologies, stimulate more experimentation with educational practices, and encourage more educators to collect data in support of evidence-based changes to the teaching and learning environment.

We hypothesize that framing the need to iteratively experiment, assess, and adapt teaching practices using evolutionary terms, key data sets, and references will connect with your biological and scientific colleagues much more effectively than merely pointing out the benefits and data of using contemporary instructional techniques. Consequently, we suggest that this new framework will more effectively visualize the multidimensional nature of education and learning; acknowledge the complexity and dynamism of the educational landscape; encourage collaboration and critical conversations about improving our current, traditional instructional methodology; and stimulate experimental thinking about how new approaches and methodology could take various fields associated with learning from localized fitness optima to more universal optima. We are convinced that additional instructional techniques are needed (and should emerge) if we collectively explain our current state in these evolutionary terms. Anyone understanding the dynamics should be encouraged to undertake the challenge of developing better instructional practices for our changing educational landscape. Consequently, consider this an exhortation to use the framework to start discussions within your professional societies, mentoring networks, with your administrators (although, sadly not all of them are biologists); and more importantly, systematically experiment with your own instruction and delivery at your institution. As with any experiment, however, be mindful of the need to replicate, thoroughly assess your results and approach your conclusions critically.

Acknowledgments

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