

Chapter 1

Learner-Centered Teaching for Environmental and Sustainability Studies

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“Teaching succeeds when learning occurs.”

(Davis and Arend 2013, p. 31)

“The one who does the work does the learning.”

(Doyle 2011, p. 1)

Introduction

Change is often very slow in educational systems (as educators are—often painfully—aware). Nonetheless, the pace can sometimes quicken when a certain zeitgeist emerges, tipping points are passed, and critical masses of interest and action lead to big-scale, possibly dramatic transformations. This volume merges two aspects of education that have rapidly changed in recent years: environmental and sustainability education, and knowledge about effective pedagogy. Its central purpose is to disseminate engaging teaching activities that instructors can use to help increase students’ environmental literacy: the knowledge, skills, and dispositions (values, attitudes, and motivation) for engaging in actions that effect positive environmental, sustainability and human well-being outcomes. More generally, this volume aims to inspire instructors to adopt learner-centered pedagogical practices that can improve student learning (see Box 1.1 for a note about the teaching-learning relationship). The target audience is primarily higher-education instructors (including graduate level), but high school teachers may find the resources appropriate for and adaptable to their courses, especially advanced ones.

Across all teaching levels, environmental and sustainability educators need diverse, well-developed, easy-to-adopt teaching resources to facilitate effective teaching that in turn fosters excellent learning (defined in this book to include

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knowledge gains, skill development, and personal growth in affective dimensions). The unavailability of such resources can often be a limiting factor for those who wish to evolve their pedagogy and try new approaches, in large part because of time constraints on developing new materials. To be sure, many teaching resources exist, especially on the Internet where searches can yield varied ideas and lesson plans from diverse sources. However, it may not be easy (nor quick) to find such materials, and searches often end in frustration. Existing resources can be limited in many ways that preclude their utility. Some may be underdeveloped, with less-than-ideal rigor and sophistication for use in particular settings. They might be tailored to the creator's personal interests and thus have limited transferability for teaching more general themes. Some resources are deeply rooted in narrow disciplinary perspectives that preclude their use with students of diverse academic backgrounds and skill levels. Most often (in my experience), materials simply do not exist for particular topics and learning goals. These challenges (and others highlighted in the next section) suggest the need for additional initiatives to formalize and share the unpublished teaching activities that many instructors have developed for their own courses.

This book helps fill the teaching-activity resource gap for environmental and sustainability studies (especially for higher-education contexts) by presenting a diverse, highly polished collection of pedagogical materials. The practicality and usability of this collection arise from its emphasis on the daily practices of teaching. It takes a "user-centered" view by presenting concisely described teaching activities with explicit and sufficiently detailed guidance to enable their (relatively) quick and easy adoption. The volume is limited to activities that require minimal instructor preparation (with ready-to-go supplementary materials provided as possible), do not require elaborate setups or specialized materials, and can be used in many course contexts (e.g., small and large, introductory through advanced). All are designed for traditional (i.e., non-laboratory, indoor) classroom spaces, and most can be completed in one or two class sessions. No matter the implementation context, each activity can create a significant learning experience (*sensu* Fink 2003) in which higher classroom energy levels and student engagement lead to meaningful, long-lasting outcomes for students' personal lives, community connections, and professional pursuits.

The rest of this introductory chapter will further explore key issues that frame this collection of teaching activities. First, the larger context around and some pedagogical challenges of environmental and sustainability education will be discussed. Second, a brief review will be provided about the nature and implications of adopting learner-centered pedagogy to highlight the value of and need for the continued shift to this approach. To foster critical, honest reflection about the approach, a third section discusses some of its inherent challenges and trade-offs; the goal here is to help readers more thoughtfully reflect about how to implement it in a personally relevant, comfortable, and balanced way that fits one's personal context, which is necessary for its effective and sustained use. Finally, some concluding reflections will be given based on my work as editor of this volume and my own teaching experiences. Overall, I hope that the volume will inspire readers to use many of its exciting teaching activities to help their students become more environmentally literate citizens who help humanity work toward a more sustainable future.

Box 1.1. Teaching or Learning Activities?

Teaching and learning exist in a kind of mutualistic-symbiotic relationship; they are intricately linked (perhaps in an obligatory way) and ideally should benefit—or at least inform—each other through reciprocal feedback. In a learner-centered context, learning is the more important of the two because the purpose of teaching is to facilitate learning, as highlighted by the epitaphs that opened this chapter. Teaching activities should therefore always be designed as learning activities. Perhaps a preferable term might be “teaching-learning activities” to indicate the intimate coupling of the two processes that should be viewed as inseparable.

In this context, why was the phrase “teaching activities” used for the title of this volume instead of “learning activities”? Shouldn’t the focus be on learning rather than teaching? Yes! However, since the volume’s audience will be composed of teachers (this is an educator’s resource, not a student workbook or textbook), readers will be examining and implementing the chapters from the perspective of the teaching role (e.g., preparation, guiding students). Second, the phrase learner centered is preferable to student centered because it emphasizes the learning aspect of being a student (as noted by Weimer 2002). Following from this, the title “learner-centered learning activities” would have sounded awkward due to its internal redundancy. In the end, the final title may not matter much, and these two phrases (learning activities and teaching activities) could be seen as interchangeable. The key insight is to remember that a book about teaching activities is simultaneously a book about learning activities, since learning must occur for teaching to occur (Weimer 2002; Davis and Arend 2013).

Environmental Issues, Sustainability Goals, and Educational Challenges

The topics of pedagogy and environmental/sustainability education coalesce around a central question: what teaching methods should educators use to help students help improve the world? In other words, how can educators help students learn how to live responsibly and sustainably on Earth to help make it—in all of its myriad environmental, human, and societal dimensions—a better, more sustainable, and thriving place for everyone, including other species in the biosphere’s diverse ecological webs? It does not seem like an overstatement to suggest that—on a planet with limited, stretched-ever-more-thinly resources and a population of seven-billion-plus-and-counting people—few questions are as important as this one, especially in educational systems that seek to positively influence the future. As David Orr (2004) suggested, “... the worth of education must now be measured against the standards of human decency and survival—the issues looming so large before

us in the twenty-first century. It is not education, but an education of a *certain kind*, that will save us” (p. 8, emphasis added). (In this context, it is important to clarify that this type of education is not, and should not be thought of as, a dogmatic, authoritarian approach that seeks to “brainwash” students into believing and acting in certain “correct” ways. Instead, the most effective environmental and sustainability education should seek to help students learn how to think critically, independently, and ethically about human-environment relationships, not specifically what to think and do.)

Orr’s *certain kind* of education focuses on the realities of human-environment relationships in the twenty-first century. In particular, it is now unassailable that humans have changed the Earth system more over the past 60–100 years than at any time in our species’ history, with dramatic, largely negative, consequences for biodiversity, the health and resilience of ecosystems, and therefore human well-being (McNeil 2000; MEA 2005). All students should understand the consequences of such changes in context of the natural and social scientific principles and evidence pertaining to humans’ dependence on biodiversity, ecosystems, and favorable environmental conditions that give rise to ecosystem services that sustain human life, health, and happiness (Cardinale et al. 2012). Further, beyond content knowledge, sustainable societies need more citizens who have the willingness and wide range of skills to effect positive environmental and sociocultural changes. To these ends, educators have responded over the past several decades by developing integrated, transdisciplinary (inclusive of the natural and social sciences, humanities, and professional fields like architecture, engineering, and business) environmental and sustainability study courses, curricula, and degree programs (Vincent et al. 2013). Their emergence and growth advance Orr’s vision for education that enables students to become sustainability leaders in their personal, public, and professional lives.

Concurrently, with increased environmental and sustainability education efforts, the past 20+ years have witnessed significant changes in scientific and philosophical understanding about the processes of teaching and learning (reviewed in the next section). In particular, evidence-based insights have led to numerous recommendations about how teaching activities and educational experiences should be designed (e.g., Bransford et al. 2000). One theme that has emerged is the necessity of using more engaging, hands-on, learner-centered pedagogies (instead of lecturing) to catalyze better learning (Kober 2015). Among the suggested techniques are project- and problem-based assignments that reflect “real-world” or “authentic” ways of helping students develop and apply their knowledge and skills. More generally, calls for “revolutionizing” the ways that educators think about and approach teaching and learning suggest the need to consider the pedagogical aspects of Orr’s “certain kind of education”—that is, a kind of education that engages students in active, meaningful, and significant learning (e.g., Fink 2003). Such education is encompassed by the term “learner centered” (Weimer 2002).

Although the educational challenge of fostering significant learning applies to all disciplines and topics, it is particularly relevant to helping students develop their environmental literacy, a complex, multidimensional process and goal (McBride et al. 2013). If an accepted primary aim of environmental and sustainability educa-

tion is for students to understand their own relationships to (including impacts on) the world and develop their capacities for effecting positive change, such education will have to help students more personally connect with the material as a means to enhancing their awareness, knowledge, and critical self-reflection abilities (e.g., Doyle 2011). Such education is needed to increase the chances that students will be prompted to modify (as needed) their affective and behavioral dimensions that relate to environmental and sustainability concerns. From this, a critical, if somewhat obvious, insight emerges: achieving the laudable but challenging goals of environmental and sustainability education is a direct function of using effective, engaging pedagogies. Learner-centered methods are especially applicable to helping students process complex and challenging information from many disciplines; synthesize and apply knowledge to solve problems; consider diverse human perspectives, cultures, and scenarios; and identify their own personal ethics, attitudes, and desired actions pertaining to human-environment relationships. Successful achievement of these outcomes requires that students be purposeful, reflective, and highly engaged participants in their own learning (Kober 2015).

The pursuit of more engaging learner-centered teaching approaches for environmental and sustainability studies can be challenging (as is true for any discipline). Many factors may limit or interfere with the ability (or willingness) of instructors to use more active pedagogical methods and materials. As discussed below, these include practical issues of the teaching context; a preference for focusing on content at the expense of explicitly helping students develop skills; and a reluctance (or uncertainty about how) to engage students' affective dimensions. (For the sake of brevity, the following discussion highlights generalized concerns without considering nuances and exceptions. Although the issues will not apply to everyone and all situations, they are likely to be common across many teaching and institutional settings. See Kober (2015) for extended discussion about these and other factors.)

Practical Challenges

Many instructors, by choice or situation, teach in contexts that make the use of innovative learner-centered pedagogy more difficult (although not impossible). Courses may be designed to include a wide breadth of content, as with introductory surveys that serve as foundational prerequisites for subsequent classes. The perceived need to “cover material” as quickly and efficiently as possible (e.g., via lecturing) places pressure on instructors to ensure that students are “exposed to” information thought to be needed for future success (regardless of whether superficial exposure results in meaningful gains in student understanding, Kober 2015). This is especially true for environmental and sustainability studies which integrate an enormous breadth of content to create a more holistic, synthetic knowledge base. In addition, the goal of such content-centered courses may be to help students learn basic vocabulary, facts, and theories which may be seen as less relevant and amenable to innovative teaching (i.e., students should just be told what they need to memorize).

Further challenges arise from noncontent issues. Many classroom spaces remain traditionally configured with rows of desks and chairs (which may be immovable) facing the lecturer. Many classes meet in short blocks of time (50–80 min) which can limit the use of project-/problem-based and other activities that require longer periods of engagement. Depending on institutional context, courses may have large enrollment numbers (e.g., >30 students) that frustrate the use of some pedagogies. (Much work, however, has focused on implementing active-learning techniques into large classes (e.g., Walker et al. 2008).) Further, although there is wide variation in instructors' professional responsibilities (including teaching loads) and locally available resources and opportunities, the materials, money, and/or time for finding, preparing, creating, and implementing new sophisticated and rigorous teaching activities are often limited. (As such, it is easier to do what has always been done than develop something new.)

Individually or in combination, these practical challenges mean that it may not be feasible for instructors to make all—or even a majority of—class meetings learner centered, hands-on, and innovative. Unfortunately, in many institutions these issues will probably remain for many instructors into the foreseeable future. To make pedagogical changes in such contexts, a key question must be addressed: how can learner-centered teaching practices and materials be integrated into traditional courses with lots of content, large enrollments, short meeting durations, inflexible classroom spaces, and instructors who are pressed for time and resources? Collections of scalable and easy-to-adopt resources geared toward such contexts, such as this one, are invaluable for assisting many instructors to integrate more innovative pedagogies into their traditional lecture-style courses.

Balancing Content and Skills

A second challenge for environmental and sustainability educators is addressing the tension between learning content and developing skills. Of course, these are not mutually exclusive, and most, if not all, instructors seek to help their students improve in both dimensions. Nonetheless, if for no other reason than limited time, a trade-off often exists in many teaching endeavors between these goals. In particular, this is due to the fact that rigorous skill development often requires explicit, purposeful, and iterative practice with focused, in-depth feedback. Although this makes helping students improve their skills more challenging (especially given the practical concerns described above), it is no longer—if it ever was—safe to assume that students' skills will automatically improve just by engaging in an activity once—or even multiple times—if instructional feedback is not provided. (This seems particularly relevant to reading and writing skills, which do not seem to develop with simple repetition for many students.) More explicit identification of skills-related goals and then aligning teaching practices with them are critical imperatives for education (e.g., as argued in the Vision and Change report about transforming undergraduate biology education; Brewer and Smith 2011).

For environmental and sustainability studies, skill development is often emphasized as part of their core *raison d'être*, especially in regard to systems and scientific thinking and problem solving (e.g., Wiek et al. 2011). Critical skills include gathering and evaluating information, evidence-based reasoning, applying and synthesizing information, and effectively communicating in many forms. As is surely obvious, teaching methods that actually engage students in doing these activities are critical for helping them progress (Bransford et al. 2000), especially through the use of many small, low-stake practice activities rather than one-time, high-stake, final projects. As such, instructors must be willing to “open up” time in their courses and curricula for multiple opportunities of sustained practice to improve students’ skills. Of course, this is easier said than done in many contexts, given the many issues that compete for faculty’s time, attention, and ability to provide students with thoughtful feedback. Further, sometimes teachers’ love for content can outcompete the desire for helping students develop their skills. Although understandable (content remains important and is often fun to explore), Weimer (2002) maintains that, “When teaching is learner-centered, content is used, not covered ... to develop ... sophisticated skills necessary to sustain learning across a career and a lifetime” (p. xviii). In other words, knowledge acquisition and skill development should be integrated within holistic lessons. The tension between balancing content and skills might be resolved, in part, by the availability of compelling examples of pedagogy that focus intentionally and explicitly on skill development while also helping students learn basic information.

The Affective Domain

Another challenge that is particularly notable for environmental and sustainability education is engaging the “whole” student, including one’s affective characteristics such as beliefs, values, and emotions, alongside motivation and optimism for “making a difference.” Research has clearly shown that knowing “things” and having skills do not necessarily or directly translate into environmentally responsible attitudes and behaviors (e.g., Carmi et al. 2015; Sapiains et al. 2015). If a key goal of environmental and sustainability education is to prepare students to become agents of positive engagement and change, students have to be inspired to want to do this, beyond knowing why it’s important and how to do it. Naturally, depending on their backgrounds and worldviews, many students who choose to take environmental and sustainability courses already have positive dispositions toward sustainability and have long been engaging in sustainable behaviors. Effective pedagogy can challenge them to clarify, refine, and develop their thinking and actions further. On the other hand, students who look negatively on (or actively refute) environmental and sustainability concerns can still be engaged in ways that (respectfully) ask them to reflect on, articulate, and justify their beliefs, values, and decisions. Rather than attempting to change their minds or “force” any views on them (as some misguided critics of environmental and sustainability education suggest is the goal), such engagement and outcomes are a crucial part of

meaningful education that seek to promote the growth of students as individual, independent thinkers and help develop their reflective, metacognitive skills (which are valuable for reasons that go beyond the sustainability context). However, students' affective characteristics (emotions, values, attitudes) are often overlooked or purposefully shunned by instructors for a variety of reasons, including the difficulty of assessing or grading personal beliefs and outside-the-classroom, nonacademic behaviors (e.g., Shephard 2008). Nonetheless, pedagogy that asks students to reflect on their own views and consider alternative ones is essential for fostering significant and meaningful learning experiences (Fink 2003). It can also help students connect with and more deeply learn important content (Doyle 2011; Kober 2015). Suggestions for how to do this effectively and respectfully, in open and supportive classrooms, may help instructors more readily consider and adopt exercises that integrate affective issues and reflective practices into environmental and sustainability courses with valuable outcomes for students and society.

These three challenges—negotiating the practical challenges of teaching, balancing content and skills development, and engaging students' affective dimensions—establish critical context for this book; providing resources that help overcome them is one of its main goals. (For additional references that describe environmental and sustainability study teaching activities, alongside some that provide generalized learner-centered teaching tips and techniques, see Electronic Supplementary Materials (ESM-A). The volume's scope has intentionally been constrained to include teaching activities that can be used in traditional college classes (meeting in short periods in rooms configured for lecturing) and that are relatively simple, inexpensive, and easy to implement (i.e., to overcome instructors' time limitations for preparation). Many of the activities (especially in Part 3) focus explicitly on helping students practice critical skills while also integrating valuable basic content; some can be used more than once with different topics to provide students with multiple opportunities to improve (e.g., Chaps. 9, 36, 37, 40). Some of the most unique and thought-provoking ones are those that directly focus on students' affective dimensions, especially through reflection about their personal views and behaviors (e.g., articulating personal statements of hope and purpose (Chap. 8), reflecting on personal tastes for food (Chap. 21), and considering empathy in the context of environmental justice (Chap. 29)). As a diverse and original collection of teaching resources, this volume will hopefully expand instructors' use of methods that can catalyze students' memorable A-HA! learning moments. More broadly, the significant learning about environmental and sustainability issues that can be fostered through the activities in this book will help advance David Orr's "kind of education" that is needed now and well into the future.

A Shifting Paradigm Toward Learner-Centered Pedagogy

David Orr is not the only person who has called on educators to reconsider how they approach teaching. In a seminal article, Barr and Tagg (1995) emphasized the need to shift the focus of our educational paradigm from teaching to learning. They argued

that the dominant “teaching paradigm” (what Davis and Arend (2013) call the “lecture paradigm”) is a teacher providing information to students (also see Fink 2003). In this context, Weimer (2002) noted that, historically, “most (educators) assumed that learning was an automatic, inevitable outcome of good teaching and so we focused on developing our teaching skills” (p. xi-xii), at the expense of considering whether the teaching was enhancing learning. A key limitation of this perspective, as she suggested, is that “the learning outcomes of teaching cannot be assumed or taken for granted” (Weimer 2002, p. xi-xii). This is especially true for lectures, which—while having some appropriate and necessary uses (see below)—are limited in many ways, especially their inability to foster the deeper, significant learning and sophisticated skills that most educators desire and students need (Ambrose et al. 2010; Davis and Arend 2013). This inability stems from a key concern that is intrinsic to all human learners: our naturally limited attention spans. Surely, all lecturers (including seminar speakers) have seen audience members (not just students!) nodding off or losing focus in the middle of a talk. (Even punctuating lectures with simple moments that engage the audience directly, like a question, can (re)capture attention.) Such limitations are revealed by research that has helped propel the shift toward a “learning paradigm” as called for by Barr and Tagg (1995).

Over the past two decades, the calls for pedagogical change have been increasing in number and urgency, catalyzed by improved scientific understanding about the nature of learning (Ambrose et al. 2010; Kober 2015). Insights from research help answer Weimer’s (2002) crucial question: “What do we know about learning that implicates teaching?” (p. xii). We now know that “learners need to be actively engaged in making meanings of new information and assimilating it into their own contexts” (Davis and Arend 2013, p. 9). We know that “learning skills as sophisticated as those needed by autonomous self-regulated learners do not develop simply through exposure to the content of disciplines. They must be taught . . .” (Weimer 2002, p. 16). In other words, we know that knowledge and skills cannot just be given to students; they must be developed by each student individually; this is the constructivist view of learning (Bransford et al. 2000; Kober 2015). More than ever, we also know (based on quantitative evidence) that a diversity of pedagogical methods that actively engage students promote their learning and overall success better than lectures alone (e.g., Freeman et al. 2014; Andrews and Frey 2015; Jensen et al. 2015).

In sum, the core conclusion from the still-evolving, but well-established, “science of successful learning” (sensu Brown et al. 2014) is clear: learning is enhanced when learners participate in engaging activities rather than passively listen and take notes during a lecture. Active learning helps students build stronger mental models to organize knowledge and facilitate its future application (Ambrose et al. 2010; Kober 2015). As presaged by Barr and Tagg (1995) in their description of a “learning paradigm,” the purpose of educational systems “is not to transfer knowledge but to create environments and experiences that bring students to discover and construct knowledge for themselves, to make students members of communities of learners” who are collaborating to help each other learn (p. 15). In other words, as emphasized by Bransford et al. (2000), “schools and classrooms must become learner-centered” (p. 23) (a phrase also used by Barr and Tagg (1995) and brought further into the spotlight by Weimer (2002)).

The shift to learner-centered pedagogy brings a set of crucial implications clearly into focus. First, as introduced above, it suggests the need to consider the constructivist view of learning, which emphasizes that each person must identify and internalize all the “pieces” of information needed to build her own “puzzle” of understanding, make sense of it, and connect it to what is already known (Bransford et al. 2000; Kober 2015). Since the process is, at a fundamental level, neurological—learning literally requires making neurons in the brain fire and rewire to create new connections—teachers, ultimately, cannot force learning to happen in others (Brown et al. 2014). For learning to occur, students must decide that they want to learn and intentionally activate their brain cells (Handelsmen et al. 2007). Although instructors can help initiate this, learning is dependent on the learner’s willingness to purposefully engage (Blumberg 2009). In other words, “learning is not something done to students, but rather something students themselves do” (Ambrose et al. 2010, p. 3). From this constructivist view, the primary (and ultimate) responsibility for learning shifts to the student, giving deeper meaning to the phrase “learner centered”—the student’s brain is literally the center of the learning process (Weimer 2002).

Following from this constructivist view of learning, an additional implication is that students emerge more clearly as unique individuals (rather than blending together into a collective class) who have varied backgrounds, perspectives, and learning needs. For pedagogical practice, this insight raises several key issues relating to personal reflection and metacognition (which relates to engaging students’ affective domain as introduced in the previous section). First, it may be helpful, if not necessary, to have students retrieve and explore their preexisting knowledge (Kober 2015). This can both remind them of what they have already learned (which serves as a basis for connecting and organizing new information) and expose gaps, possible biases, and misconceptions that may need to be changed so as to not interfere with future learning (Bransford et al. 2000; Ambrose et al. 2010; Barkley 2010). In a more immediate time frame, asking students to reflect on their own learning and understanding (e.g., what did you learn? what is its significance? what are you unsure about?) can reinforce content and skills via retrieval practice and help them and instructors identify confusion and issues that need more attention to improve learning gains (Brown et al. 2014, Kober 2015). Third, inviting students to reflect on their own personal opinions and feelings (relating to any course issues including content and process, personal and societal relevance, and students’ dispositions) is important for helping them connect with course content, thus promoting more significant learning gains (Fink 2003; Doyle 2011; Kober 2015). Further, asking students to share and discuss these reflections with their peers creates powerful learning moments that are truly learner centered (while helping them recognize the diversity of experiences and views in a group). Fink (2003) suggests that students “need to spend time reflecting on the meaning of the experiences and new ideas they acquire” if they are to become more adept at internalizing and making sense of information (p. 106). Such explicit metacognition is an important part of “helping people take control of their own learning” (Bransford et al. 2000, p. 18), which should be a primary aim of learner-centered education. Overall then, the inclusion

of reflective practice—about previous and new knowledge, feelings, and opinions—is important and valuable for creating truly learner-centered classrooms.

A third implication of the learner-centered philosophy is that the roles of the instructor must be reconsidered. In context of the expectation that students are individuals who must construct their own knowledge and take more control of their own learning, educators become more responsible for instructing students what they need *to do* to learn, rather than strictly what to know. Weimer (2002) suggests that learner-centered teachers “position themselves alongside the learner and keep the attention, focus and spotlight aimed at and on the learning process” (p. 76). As such, they are guides of learning, helping students work through learning activities (Fink 2003; Blumberg 2009). Some teachers may feel uncomfortable with this shifting view if they perceive that their role is as a “content expert” who passes information on to students. However, as Doyle (2011) emphasized, “the role of teacher as expert does not change when moving from a teller of knowledge to a facilitator of learning. What changes is how this expertise is used” (p. 53).

The expertise of the instructor in a learner-centered classroom is applied to the design and implementation of learning activities that catalyze students’ learning (Weimer 2002; Blumberg 2009; Kober 2015). That is, instructors create and manage the situations in which students will do the work necessary to learn (Barkley 2010; Weston 2015). From the teacher’s perspective, this responsibility is naturally teaching centered: what do I, as the teacher, have to do? In this framing (which is needed at a practical level), it may be easy to lose sight of the students and their learning. Thus, as posed by Doyle (2011), the key learner-centered question for the teacher’s work is, “how will (my) instructional decisions optimize the opportunity for students to learn the skills and content of the course?” (p. 2). As reflected in this question, the value of the learner-centered paradigm is that it continually—even forcefully—reminds educators to refocus on the ultimate goal of teaching: students’ learning (Box 1.1). Nonetheless, instructors retain critically important roles and responsibilities with this paradigm: they can and must still talk, sharing their expert knowledge and providing essential feedback. The key focus is for instructors to evaluate their activities in context of learning-focused questions: how will my decisions and actions facilitate students’ learning? What can I ask students to do to discover information, construct meaning, and practice skills? What questions and guidance can I provide to help them fire their own neurons and become more aware of their own thinking? In a learner-centered classroom, such questions are answered in ways that emphasize students’, instead of teachers’, responsibilities for doing more of the work required for learning.

Thinking of teaching as the process of designing “student-learning experiences” emphasizes another implication of the learner-centered view: a need for instructors to be more reflective and intentional about what they and the students are doing and why, in part by identifying clear, explicit goals (Kober 2015). (This contrasts with the “teaching-paradigm” view in which relatively less planning is needed to create lectures and exams, and no consideration about what teachers and students will do is needed; teachers lecture, and students take notes and tests.) This need brings critical questions more clearly into focus: what is most important for students to know

and why? What do they need to do to learn the chosen topics? What can students already do that will facilitate their engagement? What activities will best accomplish the learning goals? How can students show that they have achieved the goals? How can expectations be communicated to students more clearly?

Although specific answers to these questions are as varied as the courses in a college's catalog, a general framework that can guide instructors' reflection about and development of learner-centered courses and individual class meetings is that of "backward design," described by Wiggins and McTighe (2005). This "results-focused" (Wiggins and McTighe 2005, p. 15) approach is learner centered, in part, because it emphasizes, as a first step of designing learning experiences, the need to identify what students should be able to do after an activity is completed, i.e., the desired learning outcomes (also see Weimer 2002; Driscoll and Wood 2007; Doyle 2011; Davis and Arend 2013). Well-articulated outcomes should be written with precise verbs (e.g., explain, synthesize, create) to indicate the expected student actions that will demonstrate their learning and skill development (Kober 2015). (Such learner-centered outcomes differ from course- and content-centered ones often phrased as "this course will explore") Even for basic knowledge gains (i.e., students should come to know something), outcomes should still be stated with active verbs (e.g., list, state, describe) rather than the vague construction of "students will understand" which does not indicate precise learner-centered abilities.

Well-articulated learning outcomes serves several valuable purposes in a learner-centered classroom. For instructors, they are guides within the backward design approach for choosing and implementing teaching activities, including project assignments and exam questions. In this sense, outcomes help keep instructors "honest" about what they really intend for students to learn and do and serve as reminders to avoid extraneous, tangential topics and assignments that would not directly help students meet the outcomes (Kober 2015). (See Wiggins and McTighe (2005) for a thorough overview of backward design which is outside the scope of this discussion.) When outcomes are shared with students, the verbs clearly communicate what is expected of them, thus focusing their attention and fostering motivation (i.e., this is what I need to work toward). For both students and instructors, learning outcomes serve as guide posts to evaluate progress toward desired results. With clearly stated expectations in mind, instructors can focus on providing students with more directed feedback. In turn, students have more context for interpreting feedback. For instance, outcomes can be referred to when discussing why students received a certain grade or did not receive credit for an exam answer or part of an assignment (i.e., "you failed to meet this outcome; you could not satisfactorily do this"). Overall, developing and using learning outcomes are important within a learner-centered approach because they help keep instructors and students goal oriented and focused on desired learning (Kober 2015). Their ultimate value was noted by Doyle (2011): "You cannot know if your time (teaching) was well spent if you don't know what you wanted the students to learn" (p. 53).

A final implication of learner-centered pedagogy is its ability to change the dynamics and energy levels of classrooms. When implemented, learner-centered

teaching activities often replace the one voice of the lecturer with the many voices of students. Rather than quietly taking notes, students are talking to each other while solving problems, debating issues, sharing reflections, synthesizing information, and teaching each other. They are more likely to be interested, attentive, and motivated (or at least focused on achieving an immediate goal such as completing a worksheet). With certain activities, they might even be having fun, unaware that they are learning. While students work, the instructor walks around the room, talking with individual students and groups to answer questions, provide guidance, and challenge them to think more deeply. Such interactions can lead to serendipitous moments of eye-opening learning (for students and instructors) that make class meetings gratifying—the kinds of informal but excellent learning that may not be catalyzed by lectures. For the instructor, such dynamics can reveal more about students' thinking than can be observed from the front of the classroom while giving a lecture. In sum, adoption of learner-centered pedagogy can increase the levels of inspiration, engagement, and excitement in a classroom, all of which make the educational experience more rewarding, enjoyable, and memorable for students and teachers alike.

Challenges and Trade-Offs of Learner-Centered Teaching

A primary goal of this volume is to provide resources that help instructors overcome some of the challenges (highlighted above) of adopting learner-centered pedagogy. However, having a collection of teaching activities is not a panacea for all the implications that accompany adoption of learner-centered educational methods. These implications include inherent challenges and trade-offs that are not so easily overcome—in fact, using more teaching activities can increase these concerns. Most simply, sometimes activities just don't work as well as envisioned and hoped, despite the best design and implementation efforts. In addition, three others will be discussed briefly in this section: student participation and resistance, balancing the “content-class time” trade-off, and managing a (potentially) larger instructor workload. (See Weimer (2002), Blumberg (2009) and Kober (2015) for additional discussion of these and other concerns.) Highlighting such challenges and trade-offs is not intended to frustrate or deter readers from the learner-centered approach; rather, acknowledging them as legitimate and serious concerns should help readers consider and implement the approach more thoughtfully and successfully. Critical, thorough, and honest consideration of challenges and trade-offs is needed to help prevent cynicism, burnout, and abandonment of the approach. Although the challenges of learner-centered education may cause teachers and students alike to, at times, clamor for the relative simplicity, familiarity, and ease of lecturing and note-taking (which may in some instances be justified, see next section), I maintain that the challenges are not so severe that they provide just cause for disparaging the overall positive aspects of learner-centered approaches.

Student Participation and Resistance

Although active-learning pedagogy can increase the probability of student success, their use cannot guarantee that all students will participate fully and/or achieve learning outcomes. An activity that engages some students may bore or stupefy others (Weimer 2002). (Few things are as frustrating as seeing a great activity fall flat because a particular group of students don't do their part—especially when it has worked wonderfully with others.) A key challenge is helping students understand and accept—perhaps even support—the rationale for learner-centered pedagogy (Kober 2015). Clear communication about the rationale and goals for instructional decisions and activities may help achieve student buy-in (Weimer 2002; Blumberg 2009). Further, students should be continually reminded that the “responsibility to learn is theirs and theirs alone” (Weimer 2002, p. 103–104) and that they must be critically engaged to achieve the learning goals. For example, on the first day of my classes, I remind students that learning is, at a basic biological level, a process of making synapses among neurons in the brain fire; because I cannot enter their brains to make this happen, they are the only ones who can fire their own synapses. My responsibility is to provide some of the “fuel for the fire” that will help them do this, but neither I nor anyone can *make* them learn; they must *want* to learn and be motivated to take the appropriate steps to do so. Such introductory framing must be followed up throughout a course with pedagogical decisions that reflect this rather than counter it. Otherwise, students may become comfortably, passively numb (perhaps even cynical) and be resistant to an occasional learner-centered activity. Creating a truly learner-centered environment that overcomes initial resistance and frustration takes commitment, patience, and time from both instructors and students (Kober 2015).

Even with provided context and sustained use of learner-centered pedagogy, some students may remain resistant to doing more work in the classroom (especially if their other courses are lecture dominated). This is particularly true for students who have never been expected to take a more active role in their own learning or don't take classroom activities seriously, viewing them as “busy work” that wastes time (Walker et al. 2008). (This challenge may decrease as more instructors, in high schools and higher education, use effective, well-designed active-learning lesson plans.) A tough fact for teachers to accept is that it is not realistic to expect that all students will be excited and motivated by, and successfully learn with, all learner-centered teaching activities for various reasons, many of which are likely to be outside the teacher's control. For example, in my introductory ecology and evolution course, I try to use at least one active-learning technique in every class meeting (including ones that fill the entire session). Although these have engaged most students, a few have not participated fully, either doing the bare minimum needed or nothing at all (including by missing class). In an extreme case, I confronted one such student, noting that he did not do well on the previous exam and was now not engaged in the learning activity. I don't recall his exact response (he indicated that he was a philosophy major), but it was clear that he was not

amused by the course's expectations for his active participation; after this, he did not attend class for the rest of the semester and ultimately failed because he did not withdraw. When faced with such cases, we should not let ourselves be haunted by failing to meet the "perfect standard" of engaging every single student in every activity; this is an unrealistic goal because we never will. In this context, key challenges are to remain focused on the positive aspects of our pedagogical choices; give attention to students who are engaged, motivated, and learning; and adjust activities as possible to increase the chances that they will be even more successful with more students the next time.

The Content-Class Time Trade-off

Although active-learning pedagogy can improve learning (e.g., Freeman et al. 2014), implementing it generally requires more class time than just having students take notes from lectures (which is attractive, in part, for its temporal efficiency of "covering" a lot of content even if its learning efficiency is not high—in one ear and out the other, as the cliché goes). As teachers know from their own education, constructing one's own knowledge is a time-intensive process! Thus, the decision to allocate class time to activities, even relatively short ones, creates a challenging trade-off: if it takes longer for students to learn one topic via an activity, less time is available for other topics. The implication of this is that learner-centered class meetings may include fewer content details in exchange for using activities that help students more deeply explore the most important concepts and overarching, organizing principles (which may ultimately be more important anyway for supporting course- and program-level outcomes, e.g., see Brewer and Smith 2011 for biology examples). A challenge for learner-centered teachers is becoming comfortable with this trade-off and thinking more critically about what content and learning outcomes individual class meetings (and a whole course) should include and exclude (as emphasized by Wiggins and McTighe's (2005) emphasis on "big ideas" and "essential questions"; also see Kober 2015).

Does this trade-off imply that, if learning activities are used, students will inevitably miss important basic content and that learner-centered classes will be less rigorous? No, not necessarily. Learner-centered instructors must emphasize more emphatically to students that they are responsible for acquiring important information outside of class through readings, videos, and other projects (an approach now commonly known as the "flipped classroom," e.g., see Jensen et al. 2015 and references therein). (Of course, basic content can be introduced to students via in-class activities as well.) Providing students with learning outcome statements can help focus them on what they need to know. In addition, to ensure their engagement, students may need strong "encouragement" to engage outside of class through required, graded assignments that will hold them accountable (e.g., worksheets, written summaries, or quizzes). Subsequently in class, the information can be

reviewed, clarified, and, more importantly, applied, synthesized, and evaluated as part of learning activities. This facilitates the shift of the instructor's role from "teller of information" to "helper of information use and processing" and, in the context of assessing the work students do outside of class, "checker and enforcer of independent learning." Although students may complain about or resist being "forced" to do such work outside of class ("this is in-class lecture stuff!"), such an expectation follows naturally from the learner-centered approach because they are given more responsibility for taking control of their learning. Of course, instructors can also be frustrated by unmet expectations and lackluster student performance. As noted elsewhere, the key challenge is to feel confident about the instructional approach and clearly communicate to students that the pedagogical choices have been made to increase the potential for their best learning.

Instructor's Workload

Just as the out-of-class responsibilities for students become a more central focus in a learner-centered course, so does the instructor's preparatory work. The challenge here is that the workload is likely to increase as compared to using a traditional lecture-dominated mode of pedagogy. Developing and implementing new activities and assignments that are critically aligned with learning outcomes—especially over a whole course—is not easy, as most teachers know well. (Recognizing that various ways exist to implement learner-centered teaching, the comments here pertain primarily to the use of in-class learning activities that often—but not always—have students do work that creates tangible products such as answered worksheets or short writings.) In my experience, the challenges of increased time commitment arise from three main aspects of learner-centered pedagogy; although these may not universally apply to all instructors and activities, they exemplify trade-offs that may impact choices about how—and how often—to utilize teaching activities and associated assignments.

First, in its full implementation, the learner-centered approach emphasizes the identification of student-learning outcomes (see above). Choosing and articulating them for individual lessons and class meetings can be time-consuming because of the focused attention and critical reflection needed for this work: answering the key questions, "what is it, really, that I want students to be able to do; why this and not that?" is not always straightforward. In my experience, the process becomes much easier with practice, and once outcomes are identified for a course, it takes much less time to revisit and revise them in the future. Nonetheless, I have often been too busy, distracted, or—of course it happens—mentally tired to write learning outcomes for a particular class session or activity. Sometimes, I can sense my own confusion about the big-picture purpose of an activity or class session when explicit outcomes are not prepared; this reflects their value for clarifying teaching and learning aims. (As such, explicit outcomes are provided for each chapter's activity in this volume.) Although it would be ideal, expecting to always have outcomes to guide every

moment of teaching and student learning is not practical. However, this trade-off should not limit the use of engaging activities that can still foster learning even if they lack associated outcome statements.

A second key challenge for learner-centered instructors' workloads is the time needed to prepare instructional materials (including those to guide students' out-of-the-classroom learning). In my experience, this is likely to be the biggest hindrance to moving away from lecturing because it is very difficult to find or create new activities (especially high-quality ones that are aligned with outcomes) without substantial preparation—the time for which is often not available in the few days (or—often for many instructors, including me!—the night) before a class meeting. The trade-off here is to simply accept that a lecture may have to suffice in such instances (but one that, hopefully, integrates at least some interactive moments to make it more engaging; see Kober (2015) and the general resources in Electronic Supplementary Materials-A for some tips and techniques). To balance this trade-off, instructors could strive to choose a few class sessions in each course for which they begin planning learning activities weeks in advance. This may be easier said than done, but such efforts are needed to begin, and then iteratively continue, transforming courses to make them more dynamic (Blumberg 2009). On the upside, after an activity is used, it will be readily available for future use. In addition, more work is needed in the higher-education community to formalize and disseminate teaching resources (and create more peer-reviewed publication outlets for them). It is hoped that this volume will inspire such efforts which are invaluable for helping instructors overcome the frustrating prep-time challenge.

Finally, one key challenge that—unfortunately—cannot be so easily alleviated by past work and increased resource availability is the management of student-generated products that often accompany learner-centered activities (worksheets, minute papers, etc.). This includes collecting, reviewing, and evaluating them, scoring them as needed, and, as necessary and possible, providing students with feedback to guide their learning. For me, this is the most time-consuming, and sometimes tedious, aspect of taking the learner-centered philosophy to heart and implementing it as fully as possible (and I work at a smaller institution with most class sizes of 10–30; this challenge certainly scales up proportionally with increasing roster lengths). If at least one learning activity is used for each class period (as I strive to do, in-class or assigned as preparatory homework), a lot of student products are generated quickly. In addition to using them as formative assessment to help keep my finger on the pulse of student learning, I also use these products to award “participation points” (similar to attendance points but requiring that the students do something to show their engagement). Possible ways to alleviate this aspect of the workload, among others, are to not collect or score the student products, only review a sample of them, or simply check them as pass/no credit. More so than other challenges, decisions about how to manage the trade-off of student products with instructor workload are certainly an individual decision that depends on an instructor's particular preferences and context; a magic formula doesn't exist, and it may be necessary in some contexts to use learning activities much less than every class meeting to reduce this workload challenge.

Being honest and reflective about the challenges and trade-offs described above is a necessary step toward implementing an effective learner-centered teaching approach. Indeed, for each individual instructor, the biggest challenge may be the ongoing work of finding an individualized approach that “works”—that comfortably resolves the many challenges in context of all the other demands on one’s time. I wish I could provide lots of specific, detailed advice about how to respond to the challenges described above, but I don’t think that’s remotely possible. I haven’t found solutions that are applicable across all my own courses and semesters (which vary widely), much less the unimaginable range of others’ situations. However, one critical piece of advice that is often emphasized, and I emphatically agree with, is to work slowly, incrementally, and iteratively rather than to try to transform all of a course’s class meetings to be learner centered all at once (Weimer 2002; Blumberg 2009). (Also see Chap. 6 in Kober (2015) for some general suggestions about responding to challenges.) Another key recommendation I can provide is to talk to colleagues about the day-to-day struggles of teaching; others can provide helpful advice, but if nothing else, it’s reassuring to discover that many of us face the same concerns and difficult choices. For instance, despite my commitment to the learner-centered philosophy, I sometimes struggle mightily to find a good balance between implementing it strongly and maintaining a manageable workload. On some (many?) days, I daydream of assigning less work to students so that I would also have less to do. As I have been trying my best to create more and more learner-centered lessons in my courses, I often have to intentionally remind myself to remain committed to my core pedagogical beliefs while not feeling guilty when choices are sometimes made that reduce the overall learner centeredness of my teaching. As such, my best advice to others with similar concerns might be to not give up on learner-centered teaching even if its associated challenges feel overwhelming and trade-offs must be made that ultimately reduce the degree to which it can be adopted. In other words, it may be, in many instances, an honest and practical reality that “100 % learner-centered perfection” is an impossible dream. Of course, this doesn’t mean that it is not a wonderful dream or that continual attempts to achieve it should be avoided. Even adding one more engaging learner-centered activity to a course might make a positive difference for one student’s learning.

Concluding Comments and Reflections

Learner-Centered Lecturing?

Taken to its extreme, the learner-centered philosophy suggests that lecturing (defined here strictly as continuous, one-way speaking by the instructor) should be completely abandoned (as many have argued in countless articles and online blogs). Is this necessarily true, even in the strongest of learner-centered classrooms? In my opinion, no—that’s an unhelpful suggestion. Lectures should be retained as part of learner-centered pedagogy if for no other reason than to add variety to the classroom

experience (active learning in every single class could be just as monotonous as 100 % lecturing). Sometimes, a well-designed lecture can engage students very well (e.g., through captivating storytelling), focus their attention on key issues, convey enthusiasm for the subject, and illustrate (model) how a professional thinks about and organizes information (Bland et al. 2007; Kober 2015). For practical reasons, lectures may sometimes be needed when, for whatever reason, an alternative pedagogy isn't available for a particular topic. Further, many ways to engage with the world outside of classrooms expect people to have critical listening and note-taking skills (legitimate outcomes in their own right) that can be practiced during classroom lectures (Worthen 2015). For instance, many professionals attend seminars at conferences and work, where they are expected to pay attention to and learn from a speaker. Even listening to the news on TV, the radio, or a podcast exemplifies “being talked at” as a way to gain information. Given this context, a key challenge for learner-centered educators is helping students learn how to learn better when listening to speakers, no matter how boring and ineffective it may seem (MacKeachie and Svinicki 2006).

A better (and more realistic) question about lecturing is when and how the technique can be used more effectively in a learner-centered context (e.g., deWinstanley and Bjork 2002; Bland et al. 2007; Malik and Malik 2012; Gregory 2013). Most likely, a learner-centered teacher will lecture more sporadically and for shorter durations, using presentations to frame, punctuate, and complement the flow of other activities, including to provide critical “just-in-time” introductory information and instructions (as is suggested by some of this volume’s chapters that provide example introductory presentations in the supplementary materials). At a minimum, pure seminar-style lectures can be made more interactive by embedding Socratic dialogue and short learner-centered activities within them (e.g., clicker or discussion questions, think-pair-share moments; Gregory 2013; Kober 2015; see Electronic Supplementary Materials-A for general resources that describe such methods). (Such mixed-method lessons might still be referred to as “lectures” reflecting the varied ways the term is used; see Hora 2014). A key consideration is to identify when a straight lecture by itself will be insufficient to help students develop the critical skills identified in learning outcomes; the student-centered verbs of outcomes can be used to develop activities that interrupt the instructor’s talking and provide students with moments to do something other than listening and taking notes (e.g., explain, reflect, synthesize, calculate; Kober 2015). Such simple adjustments to facilitate students’ active processing of information and construction of their own understanding can go a long way toward shifting a classroom to be less lecture dominated and more learner centered.

Content of the Volume’s Chapters

Teaching activities can be presented in a variety of ways, ranging from very formal and detailed to informal and brief; certainly, one “right” way does not exist. In some contexts (especially K-12 education), activities may have to be prepared

using standard “lesson plan” templates; other educators may use formats introduced to them in their formal training. For publishing, journals and websites vary in their requirements. When developing this book project, I chose to start with an empty page and think about what I, as a practicing teacher, would want included in the description of a teaching activity. This reflection guided my decisions about the standardized outline for each chapter (with one activity per chapter; an overview of each chapter’s structure is provided in Box 1.2). Without provided guidelines, contributing authors would surely have developed their chapters in widely divergent ways. Thus, to ensure coherence within the volume, all chapters are identically structured and have been edited for consistency in tone and style. Further, I felt that brevity should be a key point of editorial emphasis; this allowed more activities to be included in the volume and should increase their attractiveness (in terms of readability and ease of adoption) and probability of more widespread use. Trade-offs surely exist for these two decisions, and some readers may be left wanting more or different information from each chapter. However, the information included in each chapter should provide the minimum information needed to make each activity “ready to go, right off the shelf.”

Assessment of Learning Outcomes

Assessment of student learning (i.e., evaluating student work to provide comments, assign grades, or for other purposes) is a critical part of teaching, especially in a learner-centered classroom, where feedback is viewed as essential for improving learning (Weimer 2002; Ambrose et al. 2010; Kober 2015). Yet, a section about assessment is not included in this volume’s chapters (Box 1.2). For better or worse, excluding assessment from the scope of each activity’s description was intentional. Assessment (or grading) is a complicated endeavor with many subtle issues (e.g., see Driscoll and Wood 2007 and Dirks et al. 2014). Philosophies and practices vary widely among instructors and across course contexts. For each of the activities in this volume, student engagement, achievement of learning outcomes, and associated products (e.g., completed worksheets) could be evaluated and scored in numerous ways (if this is even desired). Because this book’s purpose is to disseminate the activities which are, arguably, harder to devise, more space has been devoted to them at the expense of assessment and grading details which are left up to individual instructors to consider in context of their student populations, personal preferences, and syllabi. (As exceptions to this, some authors have suggested assessment (exam) questions or projects in the *Activities* or *Follow-Up Engagement* sections and provided example rubrics for scoring some student products in the supplementary materials.)

Box 1.2. Overview of Each Chapter's Structure and Content

1. *Introduction.* This section frames the larger context for the activity, explaining its connections to environmental, societal, and student-learning concerns. For brevity, it neither serves as a comprehensive overview of all related issues nor provides a thorough literature review. Authors cited only the most essential, relevant references, especially ones that can provide additional foundational information to readers with diverse disciplinary backgrounds. The general nature of the activity is briefly described so readers can start to envision its implementation. All chapters' introductions contain an explicit goal statement for the activity that speaks to the broader meaning, relevance, and implications of the intended student learning. Overall, each introduction frames the rationale and justification for why the reader should want to have their students complete the activity.
2. *Learning Outcomes.* Each chapter includes a set of three to five learning outcomes that the activity should help students achieve (see main text for context about outcomes). In true learner-centered form, outcomes are written with students as the subjects (not the course, goals, or content), followed by verbs that indicate what observable student actions would indicate learning gains (and can be assessed): "After completing this activity, students should be able to..." (This contrasts with the non-learner-centered emphasis in the phrasing "the goals of this activity are to...") Outcomes can be examined to quickly evaluate whether the activity might support an instructor's learning goals for a particular context. In addition, readers may discover that activities can be used to achieve other outcomes for other topics or goals not identified in the chapter.
3. *Course Context.* This section describes the context within which the author(s) developed and used the activity. Such information may be helpful for evaluating the activity's potential use, and possible needs for modifications, in the reader's teaching situation. For ease of reference, it is formatted as a bulleted list with the following information:
 - (a) Basic characteristics of the course for which the activity was designed, including topic, educational level, majors or general education course, and class size
 - (b) Expected duration in minutes (minimum or a range) and number of class meetings needed for the full activity
 - (c) Background knowledge or other preparation needed by students, if any
 - (d) A note about whether the activity could be adapted to (or has been used in) other course and learning contexts.

(continued)

Box 1.2. (continued)

4. *Instructor Preparation and Materials.* This section provides detailed, explicit, and precise guidance about what needs to be done before using the activity, as if it is the methods section of a scholarly research paper. In addition to basic preparation, most activities require that instructors review, and modify as needed for their own situation, resources that have been provided by the authors, such as student worksheets and example presentation slides. Preparation time varies among the activities and will in part depend on the instructor's preexisting knowledge about the activity's subject and desires to adjust the activity and provided materials.
5. *Activities.* In a step-by-step manner, this section describes precise instructions for both the instructor and students to complete the teaching and learning activities. From it, the reader should be able to clearly envision how the activity will proceed *before* implementing it (to facilitate preparation via "mental practice"). The detail and length of this section depend on the nature of the activity; as such, this section varies among the chapters more than other sections, with some using numbered or bullet-point lists for the steps. In all chapters, suggestions are provided for how instructors can guide students with background information, relevant summary talking points, clear instructions, and Socratic-style questions. This section is written for instructors; as relevant, some chapters provide separate instructions and worksheets in the online supplementary files that can be given to students.
6. *Follow-Up Engagement.* Suggestions in this section focus on how the activity's topic can be explored further in diverse ways, either by extending the activity directly (e.g., with discussion questions) or through complementary tasks (e.g., out-of-class assignments). In many cases, the suggestions could be adapted for formal assessment questions or projects (e.g., exam questions, essay prompts). To keep the chapters concise, the ideas in this section are presented as brief notes in bullet-list form and are not intended to be fully developed lesson plans or assignments; they serve to inspire readers to develop other teaching activities. When possible, other of the most relevant chapters in this volume are identified to suggest combinations of activities that can facilitate synergistic learning.
7. *Connections.* These notes indicate relationships among the topics of the chapter's activity and other environmental and sustainability study topics (especially those rooted in disparate disciplines). Sharing these connections with students can improve their abilities to synthesize information and create interdisciplinary mental models (which, as suggested by constructivist learning theory, can enhance their learning; e.g., Bransford et al. 2000;

(continued)

Box 1.2. (continued)

Ambrose et al. 2010). Other chapters in this volume that relate to the noted connections are highlighted to guide readers to additional relevant content and references.

8. *Electronic Supplementary Materials.* Contributing authors have been very generous in sharing resources associated with their teaching activities that enable their quick and easy adoption, including student worksheets, lists of additional background references, detailed instructor guides, example presentation slides, clickable links for online content (videos, articles), and answer keys. These materials are provided as electronic files on the chapters' websites which can be accessed from the book's main website. (Note that some materials needed for the activities are from copyrighted sources (e.g., articles, images) and could not be reproduced for cost or other reasons; their (online) locations or other information about how to access them should be indicated. However, if they cannot be found, please contact the author(s) or editor.)
9. *References.* For brevity, the reference list includes only core, essential references and does not reflect a comprehensive review of the chapter's topic(s). Especially for those less or unfamiliar with the topic(s), the suggested resources will provide foundational information to enable all instructors to gain the background knowledge needed to implement the activity. Many chapters list additional references in supplementary files to facilitate more in-depth exploration.

Peer Review of Teaching Activities

Higher-education professors are very familiar with the value and process of peer review for scholarly activity (e.g., for awarding grants and publishing articles). However, in general, instructors do not usually expect, or seek out, peer review of their teaching activities (unless these are formally submitted for publication, but it's probably fair to say that those who have done this are a small minority—one of the most common comments I received from authors was “I've never prepared a manuscript like this before”). Nonetheless, teaching activities can benefit substantially from critical peer review, as the editing process for this volume revealed. (Each chapter was first reviewed by two contributors of other chapters and the editor; subsequent reviews were made by only the editor.) The first drafts of the contributions varied widely in their levels of development and overall quality (in terms of content, the activity itself, and writing). Reviewers provided valuable comments about ways to improve each activity and its

presentation in manuscript form; even the most straightforward ones and those with the highest-quality first drafts were strengthened by feedback and revisions. The most common improvements were made regarding the clear articulation of learning outcomes; increasing the specificity and explicit guidance in the descriptions for how to prepare for and implement the activity so that all readers could understand it easily; and including a variety of topics and perspectives in the *Follow-Up Engagement* and *Connections* sections. Reviewer feedback sometimes provided new ideas for alternative approaches, new connections, or simple modifications to the activity that could enhance student engagement or deepen learning gains. Inevitably, such revisions led to stronger, more rigorous and sophisticated activities that are likely to be more successful at fostering student learning.

One of the most critical aspects of the peer-review process (and one that I especially emphasized as editor) was providing feedback to authors about how to better align all parts of their manuscripts and activities to enhance their internal coherence and focus. Ensuring that lessons have well-aligned goals, activities, and concepts is a challenging yet crucial part of teaching (as is emphasized in the backward design approach described above; Wiggins and McTighe 2005). This is because, in part, an intentionally designed lesson with associated activities that clearly “make sense” allows students to easily see its logical organization and work in a more focused and enjoyable way toward achieving the outcomes (Bransford et al. 2000; Ambrose et al. 2010; Davis and Arend 2013; Kober 2015), rather than struggle as they try to figure out “what’s the point?”. Many chapters in this volume were significantly improved with revisions that brought all the sections and aspects of the activity into better focus and alignment (e.g., by removing points and components that were tangential and irrelevant to the focal goals and outcomes and created confusion about the focus). Hopefully, as a result, both the writing and activities are much stronger overall.

Editing this volume has convinced me that the processes of writing manuscripts about teaching activities and peer-reviewing them are both enormously valuable. All teachers should devote more time to doing both because both can help instructors become more thoughtful and critical about their own pedagogy—which ultimately makes them better teachers. With thoughtful review, all teaching activities can be improved—sometimes subtly, sometimes dramatically—to make them more coherent, rigorous, engaging, and, thus, effective. In turn, dissemination of highly polished, well-aligned, peer-reviewed teaching activities benefits the whole educational community by enhancing the pool of instructional resources that can be easily adopted. My personal perception is that the higher-education community in general—and the environmental and sustainability studies one especially—currently lacks sufficient opportunities, outlets, and infrastructure to facilitate these processes. Hopefully, as the predominant educational paradigm continues to shift toward one focused on learning, more instructors will devote more attention and time to helping each other peer-review, improve, and share our learner-centered teaching activities.

The Joy and Necessity of Learner-Centered Teaching for Environmental and Sustainability Studies

Although this chapter has highlighted some challenges of learner-centered teaching, I hope it convinces you (if you weren't already convinced) that, on balance, the approach benefits outweigh its costs, and the associated trade-offs are worthwhile to make. If any doubt or hesitancy remains, I hope that you will at least review and implement some of the wonderful activities in this book. They exemplify many of the benefits of learner-centered pedagogy, especially its enormous potential for fostering significant learning outcomes. (I used several of them while finalizing the book with positive results.) Personally, I remain committed to this approach despite its challenges because of my many encouraging experiences with it, including hearing appreciative student feedback. One key benefit that keeps me committed to it is the joy—the deep feeling of fulfillment that comes with meaningful accomplishment—associated with creative learner-centered teaching and seeing students engaged in active learning (a point also emphasized by Davis and Arend (2013)).

For teachers, joy can be enhanced by shifting from a teaching to a learning paradigm (Barr and Tagg 1995) because of how the latter frames and informs the work of teaching (as reviewed above). Instead of lecturers (and maybe discussion leaders), learner-centered instructors are designers of learning scenarios and inspirational and motivating guides who assist and challenge students to learn deeply while completing learning activities (Weston 2015). Taking on these roles opens the door for instructors to create more unique, varied, fun, thought-provoking, exhilarating, memorable, and—ultimately—rewarding and effective teaching activities. Further, as students are working in the classroom, instructors can facilitate their serendipitous A-Ha! learning moments through small-group and one-on-one discussions. Such interactions allow the observation of real-time student learning which yields smiles and genuine enjoyment from teaching. In my experiences, learner-centered pedagogies are much more likely than lectures to create such satisfying moments. Thus, using more of them can enhance the overall joy of teaching and generate more reminders about why educators love the teaching profession.

Similarly, learner-centered teaching activities can increase students' enjoyment of learning experiences. This is because, as teachers know well, the work and outcomes of successful learning can produce joy, exemplified by the pleasure of one's "mental light bulb" going off from a new insight. (Whether or not students are reflective and mature enough to recognize this type of joy in the moment is another question.) Since significant learning (sensu Fink 2003) is facilitated by learner-centered pedagogies, they are more likely to cultivate joy than non-learner-centered approaches. In part, this can be attributed to how they help create dynamic, energized classrooms that keep students awake, attentive, talking, writing, and thinking deeply and critically (rather than bored, drowsy, and distracted by their electronic devices, superficially listening and passively taking notes). Further, laughter and other positive social interactions can be wonderful results

brought about by teaching activities, especially those arising from serendipitous and unique teachable moments. Although cultivating joy may not be a focal goal when designing teaching activities, their potential to do this suggests another valid reason to use them more often. Arguably, more joyful students are likely to be more interested, cooperative, and successful learners.

The abilities of learner-centered teaching to engage students point to their necessity for promoting excellent and joyful learning. Beyond this, the larger societal context of education should also guide pedagogical choices. In particular, the extraordinary environmental and sustainability challenges confronting humans around the world demand responses from educational systems (Orr 2004; MEA 2005). A first educational response is to increase efforts to help students more deeply construct transdisciplinary understanding of the diverse information (vocabulary, principles, questions, etc.) within environmental and sustainability studies (as reflected by the wealth of topics across this volume's chapters). Further, a critical educational goal must be to help students improve the skills and mindsets that will enable and motivate them to become socially and environmentally responsible and engaged problem-solvers and citizens. In particular, capacities for critical self-reflection are needed for them to recognize and honestly evaluate their own environmentally related beliefs, choices, and behaviors. Simply put, a teaching-centered paradigm is inadequate to achieve these crucial learning outcomes, especially given the high societal risks associated with failing to help students achieve higher levels of environmental literacy. As reviewed in this chapter, the best available scientific evidence indicates that learner-centered teaching approaches have higher efficacy for helping students achieve long-lasting, meaningful, and significant learning gains. In context of environmental and sustainability studies, a strong learner-centered teaching paradigm is a necessity for helping students become highly knowledgeable and skilled sustainability leaders.

In sum, the future sustainability and well-being of humanity and the biosphere depend on the environmental and sustainability education community's adoption of learner-centered pedagogies (Barr and Tagg 1995). The teaching activities in this volume aim to inspire and enable instructors from across disciplines and diverse teaching contexts to create more effective learner-centered classrooms that improve students' environmental literacy. I hope they bring joy to you and your students as they help transform our education systems in ways needed to support humanity's transition to a more sustainable future.

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