Designing a Real-World Course for Environmental Studies Students: Entering a Social-Ecological System

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Abstract: There is increasing interest in using "real-world pedagogy" to train students in ways that make them better able to contribute toward a more sustainable society. While there is a robust body of literature on the competencies that students need as sustainability professionals, there is a lack of specific guidance in the literature on how to teach for competency development or on how to structure a program or course to support competency development. Our research addresses this gap in the literature through a description and autoethnographic reflection on the design and early implementation of a "real-world" course. The course is from the Environmental Studies Program at Dartmouth College (Hanover, NH, USA), but it takes place in the environs of the Gobabeb Research and Training Centre in the Namib Desert of Namibia and in nearby Topnaar settlements. Our research objective was to articulate strategies to address the primary pedagogical challenges that we faced during the design and first five iterations of the course. These include: How do we frame this course and communicate it to students in a way that is understandable and works within the particular context and constraints of the course? Can we provide students with a coherent framework that helps them to understand the approach and also provides a platform for thoughtful consideration, acquisition, and retention of appropriate competencies? How do we develop collaborations with our community partners that are ethical and effective? How do we frame these real-world experiences in a way that allows for students to integrate their experience with the theory and broader empiricism they learn on campus? To address these pedagogic challenges, we framed the course as a research-based course, more specifically community-based research (CBR), conducted in a social-ecological system (SES). We developed lower-level strategies for implementing this framing, including preparing students for collaborative research, encouraging student ownership of their learning, linking theory to research, and thoughtfully navigating time constraints. Furthermore, program-level and student-level engagement with community have been critical for avoiding becoming "helicopter researchers." Drawing on our personal reflections and those of our community partners, we conclude with a discussion of emergent outcomes and the next steps for continual improvement and adaptation.

Keywords: social-ecological system; community-based research; environmental studies education; sustainability education; real-world pedagogy; Namibia

1. Introduction

The related fields of environmental studies, conservation biology, and sustainability science (and others) are searching for ways to make higher education more practically relevant in efforts to move toward a more sustainable society [1,2]. Numerous papers have attempted to identify the competencies that are needed to do this work and have called for their incorporation into university curricula. A partial list of these competencies includes: problem solving [3], inter- and transdisciplinary proficiency [4], systems thinking [5], collaboration skills [6], communication [7], understanding how values and ethics shape problems and solutions, incorporating diverse opinions and knowledge [7], and applying theory to practice. There is broad consensus that these are worthy educational goals, and numerous studies have evaluated these learning outcomes (e.g., [8,9]). However, many of these competencies involve vague concepts for which even specialists have trouble agreeing on operational definitions. Thus, it is not surprising that there is a lack of specific guidance in the literature on how to teach for competency development [8,10], or on how to structure a program or course to support the development of these competencies.

One approach that colleges and universities are taking to teach sustainability competencies is to embed students in a real-world setting—a setting outside of the confines of the academy—and ask them to accomplish something. Higher education institutions that are interested in teaching sustainability competencies are making significant investments in off-campus educational opportunities and other real-world approaches, both domestic and international (e.g., Arizona State University's School of Sustainability; University of Maine's Senator George J. Mitchell Center for Sustainability Solutions). The practical nature of these off-campus programs offers an opportunity for students to gain much needed experience and skills in interdisciplinary thinking, collaboration, and engaged research. Being embedded in the system under investigation presents students with a completely new context within which to learn. This new context is critical for learning, because, as experiential learning theorists assert, "learning results from synergistic transactions between the person and the environment" [11], whereby students assimilate new experiences with prior learning and modify prior learning through new experiences. This trend of off-campus programming has spurred thinking about "real-world pedagogy" [3], including about how to design courses and programs and what are the outcomes of these programs.

Despite the increasing enthusiasm for real-world educational approaches, there are many challenges to implementing these programs and there is relatively little literature to guide the development of these types of courses (exceptions include [3]). To help address this gap in the literature, this paper describes the development and implementation of a hands-on, field research course with students and faculty from Dartmouth College, a liberal arts college in New Hampshire, USA, which is conducted in Namibia in southern Africa. We share our reflections on course design strategies and the challenges that we and our students faced in the design and implementation of this real-world course. Our research objective was to articulate strategies to address the primary pedagogical challenges faced during the design and first five iterations of the course. These include: How do we frame this course and communicate it to students in a way that is understandable and that also works within the particular context and constraints of the course? Can we provide students with a coherent framework that helps them understand the approach and also provides a platform for thoughtful consideration, acquisition, and retention of appropriate competencies? How do we develop collaborations with our community partners that are ethical and effective? How do we frame these real-world experiences in a way that allows students to integrate their experience with the theory and broader empiricism they learn on campus? While the specifics of our strategies, such as the theory and content of the course, may only be relevant to environmental studies programs or similar fields of work, the strategies that we develop here are relevant to any number of disciplines.

Prior to discussing program design, we provide background on the course and the setting in which it takes place.

2. Materials and Methods

2.1. Course Background

This new "real-world" community-based, field research course (ENVS84, hereafter "the course") was an enhancement to a program, established in 1983, which focused on the interplay of environment and development in southern Africa. Although the focus remains the same in the current iteration, the implementation of the course and the learning process is vastly different. Students and faculty from Dartmouth College spend a trimester (10 weeks, hereafter "the program") studying the conservation and management of natural resources, including wildlife, biodiversity, water, minerals, and agricultural land, while traveling in South Africa and Namibia. The program visits a variety of sites employing different approaches to the conservation and development nexus. These include national parks, private game reserves, cattle farms, community conservancies, watershed based management collaboratives, predator focused NGO's and scientific research stations. Students take three courses over the 10 week period, the first two of which (ENVS 40 and ENVS 42) conclude prior to the start of the course addressed in this paper, ENVS 84, which occurs during the last two weeks of the program.

The course is based out of the Gobabeb Research and Training Centre in the Namib Desert of Namibia (www.gobabebtrc.org). This location provides a unique opportunity to study the complex relationships among a scientific field station (Gobabeb), a local community (the ≠Aonin Nama or Topnaar), a National Park (Namib-Naukluft Park), and the environment of the Namib Desert. The Topnaar people are a Khoekhoegowab-speaking community whose historically documented presence along the Lower Kuiseb River dates back 350 years, and their archeological presence much further [12]. The Topnaar rank among the most disadvantaged people in Namibia due in part to restrictions on livelihoods from living within protected areas (Namib-Naukluft Park established in 1907; the Dorob National Park in 2011), unemployment, low literacy levels, and poor service provision [13]. Consequently, many Topnaar people have migrated to nearby urban centers in search of employment. Among those still living along the Kuiseb, urban remittances and government pensions are among the primary cash income sources. But, many also still rely on traditional means of subsistence wherein the narrow ribbon of riparian vegetation is the mainstay for their livelihoods. Among these, livestock production is the primary income-generating activity [13]. Although some households maintain small vegetable gardens, the area is too dry and water is too valuable for extensive gardening. Most households also gather !nara melons (*Acanthosicyos horridus*), a Namib endemic plant that has a prominent place in Topnaar culture. In the past, harvested melons were traditionally processed and then dried to feed the household over the next year, but products are now also sold to provide some cash income. The interests of the community are represented by the Topnaar Traditional Authority (TTA).

Gobabeb is a non-governmental research facility that currently operates as a joint venture between the Namibian Ministry of Environment and Tourism (MET) and the Desert Research Foundation of Namibia (DRFN). Established in 1962, the Centre annually hosts over 250 scientists across a range of disciplines. Over its history, Gobabeb's primary focus has been basic research on the desert ecosystem and atmosphere. However, since Namibian independence in 1990, training Namibian students and environmental professionals has also been an important part of its mission. It has engaged with the Topnaar community on a variety of capacity-development initiatives, including skills-based training programs, scholarships, and exchange programs with similar communities.

2.2. Our Research Approach

We used autoethnography to analyze our experiences with the program [14]. This qualitative method uses self-reflection on one's experience as data to begin the exploration of "broader sociocultural issues" [15], in this case, how to teach a real-world, community-based field research course. Like Chaves et al. (2016) in their use of analytic autoethnography, we are members of the program of which we are studying; our voices are evident in our analysis, and we seek to contribute

to the broader literature on a topic or social phenomena [16]. Although the co-authors had talked with each other about the course in the process of annual planning and teaching, we had not yet embarked on such an in-depth process of reflection to identify and name our pedagogical strategies. Our formal process of reflection began in November 2016 when the Dartmouth-based co-authors began to document and meet about our experiences on the program, our lessons learned, and our perspectives on student outcomes in the course. Using Dropbox, we developed a shared document to collect our reflections and then we worked through each reflection during meetings until we came to agreement about our most notable reflections. This process allowed us to articulate nuances in our reflections and allowed each of us to critically analyze and question our positions [17]. Early in our writing process we met at least monthly. Since January 2018, we have met almost weekly to discuss our reflections, explore interpretations of experiences relative to the literature, and develop this manuscript.

Recognizing our subjectivity and the bias in our perspectives, we sought to gather insights from co-authors and colleagues in Namibia. To do so, we developed a semi-structured interview protocol to help guide the conversation and focus their reflections on topics related to course design, management, and outcomes. The discussion with Joseph Tjitekulu took place in November 2017 while members of Dartmouth were at Gobabeb. The discussion with Gillian Maggs-Kölling took place via Skype in April 2018, although we also discussed the general themes of the manuscript and shared a copy with her in November 2017. Both of the meetings were digitally recorded, with their permission. Insights from our Namibian colleagues informed the development of the paper and are captured in Box 1 and 2 in the manuscript. Numerous prior conversations with our partners also informed what we present here.

We came to this endeavor from a variety of perspectives that no doubt helped to shape its evolution. DTB is an ecologist and faculty member at Dartmouth and has taught on the Dartmouth Africa program since 1995. KHB is a practice-based learning specialist at Dartmouth and does research on university-community collaborations. FEK-T is a Ph.D. student whose research focuses on insect-plant interactions. DTB, KHB, and FEK-T were all involved in designing and teaching the course from the Dartmouth side (DTB all five offerings, KHB and FEK-T, four offerings). GM-K is a botanist and the executive director of Gobabeb and has hosted and interacted with the course through all five iterations. JT is a member of the Topnaar Community and the Topnaar Traditional Authority and was employed by Gobabeb as a community liaison during several iterations of the course. We believe that this diversity of perspectives led to the richness of our interpretations and our reflections.

3. Results

3.1. Lessons Learned in Program Design and Implementation

In designing the new course, we had many aspirations that we label as design criteria in Figure 1. Primary among them was that the course be hands-on (constructivist) and collaborative, requiring that students take ownership of their own learning. Furthermore, we required that it thoroughly engage the human and ecological dimensions of an issue in an interdisciplinary way, and that students connect their activities in the course to the skills, theory, and broader empiricism taught on campus and available through the scholarly literature (Figure 1).

Below, we distill our challenges and experiences in the design and initial five offerings of the course into three primary lessons.
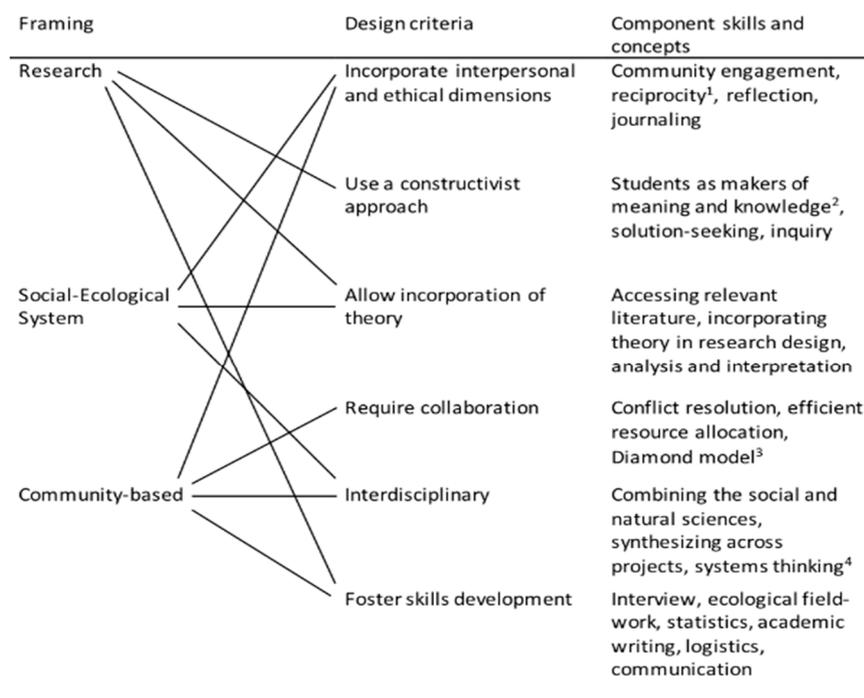
Framing	Design criteria	Component skills and concepts
Research	Incorporate interpersonal and ethical dimensions	Community engagement, reciprocity[1], reflection, journaling
	Use a constructivist approach	Students as makers of meaning and knowledge[2], solution-seeking, inquiry
Social-Ecological System	Allow incorporation of theory	Accessing relevant literature, incorporating theory in research design, analysis and interpretation
	Require collaboration	Conflict resolution, efficient resource allocation, Diamond model[3]
Community-based	Interdisciplinary	Combining the social and natural sciences, synthesizing across projects, systems thinking[4]
	Foster skills development	Interview, ecological field-work, statistics, academic writing, logistics, communication

Figure 1. We frame our field course as community-based research (CBR) in which we engage with a social-ecological system (SES). This framing grew out of our design criteria and the competencies we hope our students will develop. [1] [18], [2] [19], [3] [20], [4] [5].

3.1.1. Lesson 1: Framing the Course Matters

In our experience, a clear and explicit framing for the course is essential to guide student expectations, help them orient to course partners and to the on-campus curriculum, and to fully address course goals (Figure 1). Several different pedagogical approaches to getting students out of the classroom and into the "real-world" have been presented in the literature, including experiential learning [11], project-based learning, problem-based learning, and service learning [3]. Although a consideration of each of these approaches was useful to us, we found that none of these definitions fully fit the aims and context of our course. In particular, we found it difficult to tie these concepts to the on-campus curriculum and we felt that elements of these framings were problematic for our course that involves students from the global north engaging in environmental issues in the global south.

Both problem-based and project-based [10] pedagogies emphasize framing environmental issues as "problems" and the process of addressing those problems as "finding solutions". In the context of our course, this framing was problematic for several reasons. First, when conducting research in communities and with community partners, this framing can be alienating because it assumes that the community has problems, names specific issues as problems, and further assumes that we—outsiders—can solve problems within the community. Second, the relationship that this framing articulates is particularly problematic because we are working in a post-colonial context. A service learning framing raised similar issues. Both concepts, serving the community or helping solve a communities' problems, help to perpetuate the perception of a hierarchical relationship between the students and faculty and the community. Finally, the concept of problem- and project-based work leading to specific solutions suggested that issues under investigation during the course were relatively simple issues that could be fully addressed in a relatively short period of time. This was inconsistent with the complexities and open-ended nature of this endeavor.

While we recognize that the literature on these pedagogies addresses some of these concerns, we found it difficult to conceive of a way of presenting the course to students that would not create initial impressions and expectations that would be difficult to dispel later. In our program, instead of

assuming that there is a problem to be solved, we describe our work as "engaging productively" in the system, which leaves it open for students to define their own questions and strengthen the tenacity and creativity that research demands in such a setting [21]. As explained in detail below, we found that conceiving of our course as community-based research in a social-ecological system worked better to both situate our course ethically and to integrate it with the curriculum. Ultimately, we chose student research as the primary learning activity, our research topic as the social-ecological system (SES) that we are part of at Gobabeb, and community-based research (CBR) as our research approach. Below, we elaborate on each component of this framing.

a.　Research

Student research is the constructivist activity we use to enable learning, foster active student engagement, build relationships with community members, and to produce information of value. Teaching through research fosters higher levels of student engagement than the typical classroom setting and facilitates the development of skills for problem solving (e.g., [22]). Further, an immersive field environment promotes deep learning [23]. Mogk and Goodwin [24] emphasize that, in the field, students make their own decisions about what is important and how to present that information, rather than receiving information filtered through an instructor. In addition to increasing information assimilation [25], our framing encourages our students to iteratively ask: what is unknown or needs further understanding in this system? What does it mean to be productive? How may we–and should we–engage to address information gaps? The teamwork, problem-solving, and relationship skills that were developed in the process may shape students' career motivations and help them to feel prepared to address complex questions in their future work [26,27].

b.　Social-Ecological System

During our course, professors and students enter a social-ecological system (SES; [28]), of which we and the course are a part. An SES framing emphasizes the dynamic coupling between the human and biophysical dimensions of ecosystems, and thus, accommodates and requires an interdisciplinary perspective. Our department and our students have wide-ranging interests in the natural and social sciences and the humanities, and the SES concept is broad enough to encompass this range of interests. Equally important, it allows for us to conceive of our program as one of the components of such a system, enabling a more active, reflexive, and collaborative approach. Placing ourselves in the SES allows us to identify a research topic, the SES, without imposing a subject-object relationship.

The SES framework has been the subject of much theoretical elaboration (e.g., [29,30]). A number of conceptual frameworks have been constructed around the base concept of the SES and related ideas [31]. It was not our intent to structure the course and the research fully around that body of work. Doing so would require a level of theoretical sophistication beyond what we deemed useful in this context. Instead of a more elaborate theoretical framing, we simply asked the students to "engage productively with a real social-ecological system". This helps to keep the focus on understanding the SES and our roles within it, directing our emphasis toward choosing ideas and methods that are useful in understanding and participating in the system.

In addition, the SES framework guided our choice of Gobabeb as the course location and it influences the portfolio of research topics we consider each year. For example, much of our initial research focused on the !nara plant, and its social and ecological dimensions. Each year, when we work with our partners to develop a list of potential projects for students to work on, we make sure to include projects that are focused on the biophysical system, the social system, or both. We also attempt to bring both social and biophysical scientists on the program to assist students in their research. It is important to note that, while students are able to select projects of interest and innovate within those projects, it has been critical for student and program success to develop a list of potential projects to inform their choices and align project foci with community partner needs.

c.   Community-Based Research

The final piece of our framing helps to describe our position relative to two members of the SES with whom we interact closely: Gobabeb and the Topnaar community. It is far too easy in an annual, short-term, student-focused course to prioritize student learning and research over community interest and needs and to limit our interactions and experiences to working only with like-minded, similarly trained people (e.g., Gobabeb scientists). However, such an approach runs counter to our conception of the course as responsible to and interconnected within the SES. Both personally and pedagogically, we desire to create a relationship with our partners that is collaborative, inclusive, ethical, and reciprocal [32,33].

To this end, we framed our work as "community-based research" (CBR), which helped us to identify critical ethical and practical guidelines for our engagement. Community-based research is an approach to conducting research that works *with* community members to conduct research on problems or topics of mutual interest [34]. CBR emphasizes "the participation and influence of nonacademic researchers in the process of creating knowledge" [34] and the equitable and respectful inclusion of diverse forms of knowledge throughout the research process [34,35]. CBR is one of several approaches to collaborative or engaged research, including community-based participatory research (CBPR) and participatory action research (PAR), among others [33]. Although the specific foci and goals of each approach vary, they share common principles [33,34] and practices [36], such as researchers and community members participating equally in the research process, learning among academic and nonacademic partners, co-identifying research problems [36], and balancing research and action [33,34]. These principles and practices guide our entire research process in the course, as well as our interactions with community partners.

3.1.2. Lesson 2: Helping Students Engage Productively in the SES Is Complicated, but Achievable

Engaging productively in the SES is complicated and it requires risk-taking and a willingness to embrace the inevitable ambiguity that accompanies such engagement. We and the students grapple with challenges and anxieties during the conduct of the course. Despite these complexities, productive engagement is achievable. The following section discusses some of these challenges and details course design strategies that address these challenges and capitalize on the opportunities these challenges present. For context, Table 1 outlines how the course progresses over the 15-day duration, identifies key components of each phase of the research, lists the community-based research questions that influence research decisions, and explores key challenges of each phase.

a.   Preparation for Collaborative Research

Guiding students through the research process—often for the first time—in the field presents a unique set of challenges and opportunities. During orientation sessions the term prior to the course, we begin discussions about community engagement. Students read two articles about community-engaged research [18,33] and then participate in structured discussions to explore these concepts. In the days prior to the start of the research course at Gobabeb, students are asked to respond to prompts that are designed to help them reflect on key concepts (e.g., reciprocity) from the papers read during orientation and on their experiences with communities in the prior two courses, ENVS 40 and 42, in Southern Africa. Finally, students are encouraged to bring theory and experience together to think about how they want to approach their work with communities during their upcoming research.

Table 1. The research process; components, challenges and relevant CBR questions.

Day	Phase	Components	CBR Questions [1]	Challenges
1	**Introduction to the study system**	• Review prior years' project reports • Lectures by faculty • Presentations by Gobabeb & Topnaar • Hands-on introduction to the local ecosystem and possible research topics	• Who else do we need to talk with to develop our list of projects?	• Getting up to speed in a short period of time • Doing preparation in advance
2–3	**Formulating research questions**	• Small group formation based on shared interests • Identification of initial research questions based on partners' initial topic proposals • Literature search • Data collection plan	• What are community and scientist expectations in terms of what will be accomplished in the project? • How do we resolve tensions in expectations?	• Stakeholder priorities, available resources, prior student research topics constrain options • Student frustration with perceived limitations on choice • Students become overly strategic based on perceived project difficulty
2–9	**Primary data collection**	• Develop and refine methodology • Students work with community members • Field data collection (i.e., students, faculty, and community partners) • Continually update research plan and daily schedule • Day 4: Each group presents project outline, hypotheses, field plan	• What methods will we use, and how do community partners want to and can be involved? • What are community capacities? • What methods will work for long-term studies beyond the course?	• Changing community liaison from Gobabeb resulting in delays in connecting students with Topnaar community members • Premature lock-in • "Wheel spinning" • Group dynamics challenges; getting stuck in the "Groan zone" [2]
10–14	**Data analysis and synthesis**	• Travel to Swakopmund, coastal town with resources including fast internet • Data entry, analysis, and report preparation • Technical skill building (e.g., data management, statistical analysis, GIS, results interpretation, scientific writing) and sharing, working closely with instructors.	• Who owns the data? What are the implications of analysis/findings? • For qualitative, social science research, how do we member-check our data to check interpretations?	• Multidisciplinary projects require diverse skill sets • Dartmouth's liberal arts curriculum means that students do not have a consistent background or skill set • Limited time
15	**Present research findings**	• Students return to Gobabeb and present to a group of partners from Gobabeb & Topnaar settlements • Final papers edited upon return to Dartmouth • Bound copies distributed to partners the following year	• How do we get feedback from the community on the research? • What are the best modes for communicating research, especially to non-English speakers and those with varying levels of literacy?	• 1-year delay in dissemination of full research findings • Formal scientific presentation and write-up of research findings is inaccessible to some of our community partners

[1] Questions based in part on Silka's (2003) online workshop "Building Strong Community University Partnerships", cited as part of Silka and Renault-Caragianes' discussion [37] of their research partnership model. [2] [20].

We also provide preparation for student research team collaboration by introducing a variety of tools for navigating the collaborative decision-making processes and the resolution of conflicts that may arise. During orientation, students complete the Thomas-Kilman [38] Conflict Management Style Worksheet to understand their conflict management tendencies and provide a vocabulary for discussing differences. During the course, students participate in interactive idea-mapping exercises and workshops about the dynamics of participatory group decision-making, including how to identify and get through the "groan zone" as they struggle to bring together conflicting ideas [20].

b.　Student Ownership

Field-based learning, like other non-traditional educational experiences, presents an opportunity for students to take responsibility for their own educational outcomes [39,40]. Ernst et al. [25] observed that inquiry based learning fosters high levels of student ownership as hands on research necessitates a high level of autonomy and independent thinking, along with strengthening collaboration skills. For field-based natural history programs, they found that several key factors fostered a sense of ownership among students: (1) preliminary instruction followed by student development of research project ideas; (2) "open-inquiry" projects [41] where students develop, test, and refine their own strategies for project implementation; and, (3) opportunities for students to communicate their results to a broader audience. Our course incorporates each of these elements.

Further, working with communities external to Dartmouth increases students' sense of ownership and personal responsibility for their research and its potential impacts. Lambrechts et al. [42] identifies these skills as the sustainable development competencies of responsibility and personal commitment, and Lozano et al. [5] similarly calls them personal involvement. This level of student ownership and personal investment is infrequently encountered in on-campus courses.

c.　Linking Theory to Research

We teach research as a method for gaining greater understanding of an SES and thus enabling better problem-solving and decision-making. But, effective research requires that students understand theory and broader empiricism through interaction with the academic literature. It is our intention that students consult the academic literature throughout their research process. We facilitate this by providing them with basic literature search skills and key citations for their research question(s). In the initial stages, the literature can provide conceptual frameworks and vocabulary to facilitate the framing of questions. During the analysis phase, they can access ideas for data analysis. In the interpretation phase, they can compare their results with those of others in this or similar systems.

Ideally, the literature provides the larger context in which students embed their work. In practice, this synthesis is less complete than we would like, and we have found this to be among the most difficult skills for us to teach and students to acquire. This is a complex intellectual undertaking, and not all the undergraduate students are academically prepared for it (e.g., [43]; Case study 1). To help address this, we employ scaffolding through prior course assignments. In one of the courses completed prior to the start of this course, students keep a research journal with entries about their observations on a personal research topic (e.g., water scarcity, human-wildlife conflict) and conversations or interviews that they conduct on the topic. Additionally, they read the academic literature to find concepts or theories that they use as analytical tools to gain further insight into their topic. As a final product, students compile an annotated bibliography that formally analyzes their topic with five articles from the literature, synthesizing academic literature, observations, and interviews. As part of that course they are given examples from our own experience and prior student work of this kind of synthesis. This preparation is helpful, but it still remains a challenging task to apply these insights during the pressures and time constraints of their field research at Gobabeb. This is an area of skills acquisition that requires further development.

d. Navigating Time Constraints

There is an inevitable tension between conceiving of our course as part of the SES and being present for only a 15-day period each year. Consequently, it is critical to make the best use of the time that is available. Time constraints are felt more acutely at certain points in the course. The transition from project formulation and design to data collection (Table 1) is a juncture at which the students need help navigating time constraints. Students acutely feel time pressure, as they must quickly get up to speed on the literature, research project topics and data collection methods, try out those methods, and begin actual data collection. Experience shows that groups will either respond by wanting to quickly begin their data collection, which often leads to a premature commitment to a research plan that has not been fully thought through, or groups try to plan, strategize and think themselves far along in the project before actually collecting any data, which can lead to wasted effort as the plans and strategies are found wanting when confronted with pilot data. In both cases, student anxiety increases rapidly in the face of limited time in the field.

There is an inherent tradeoff between giving students a lot of direction to help them get on track quickly versus allowing them to find their own way through the initial stages of project design with little intervention. While providing more direction may reduce stress, some amount of trial and error is critical for them to learn about the process of conducting research. Finding the sweet spot of encouraging rapid commitment to a research direction, while allowing for room for experimentation and project evolution is difficult. Over the past five years, we have adapted the course calendar in an effort to provide students with sufficient time for each stage of the research process. We have concluded that our current time allocation (Table 1) allows for an intense, sustained focus that gives students the powerful opportunity to be immersed in an experience quite unlike any on campus. If we devoted more time for research, it would be easy to lose that intensity and level of focus and fatigue would set in—but having less time would further limit what we are able to accomplish. Time will remain a commodity in delicate balance.

e. Opportunities for Reflection and Providing Feedback

Student research in a community setting provides an opportunity for an assessment of one's own role in the SES being studied, and we ask students to be active in and aware of their personal growth. Self-reflection as a part of the research process is a key component in cooperative learning [44], as well as in service-learning [45] and experiential learning [11]. As Kolb and Kolb [11] note, reflection is part of a learning cycle or "recursive process" of knowledge construction (p. 194). Reflection is critical for identifying and processing new experiences to produce new understandings of the world, and potentially modify actions. Without reflection, we may experience without understanding what the experience tells us or how we are reacting to it. We may fail to integrate it with our current understanding of the world and to then grow and change from the new information.

Our strategies for promoting reflection include: (i) a pre-Gobabeb prompt that asks students to reflect on their experiences with communities earlier on the program, their insights on reciprocity in these exchanges, and how these insights may influence their work with the community at Gobabeb; (ii) in-field discussions that occur during the research project; (iii) small group reflections at multiple junctures; (iv) scheduled team check-ins where research projects and research experiences are discussed; and, (v) several short reflection essays at the end of the course. Students are also asked to keep journals during the two courses preceding ENVS 84 while in Southern Africa, again providing scaffolding for reflection. In years 1–3, students also kept a journal during ENVS 84. However, we dropped the journal assignment because there was insufficient time for journaling during the research process. Reflection after the experience via responses to prompts proved more successful at yielding deep reflection.

In addition to providing opportunities for reflection, faculty provide in-depth feedback to students. Residential field courses where instructors and students live and work side-by-side offer powerful opportunities for this that cannot happen in a campus environment, and we take advantage of these opportunities. In addition to grades, faculty provide detailed assessments of student strengths and

areas for improvement, including observations of their growth over the course of the program and their success with skills, such as group decision making, problem-solving, and collaborative learning. Such observations are only possible because we work so closely with students and develop a level of trust over the course of the program. These close interactions are a critical component of the program, as they accelerate learning and facilitate an adaptive research process. They also mirror and provide preparation for real-world workplace situations students are likely to face after graduation. Learning quickly from feedback is critical to student development and success during this course.

3.1.3. Lesson 3: Being Part of the SES Means Avoiding Becoming "Helicopter Researchers"

University faculty participating in community-university partnerships have been criticized for seeing the community as a laboratory for student learning, instead of treating them as partners [46]. Working with indigenous communities, Hodge et al. [47] describe issues with "helicopter" researchers, or researchers who "'fly in', collect the data, and 'fly out' with little, if any, interaction with the community" (p. S43). Faculty have also been criticized for using community resources, such as time, without giving anything back [48]. This includes failing to share findings [32]. Among the most significant implications is that communities may be exploited [32], albeit often unintentionally.

Recognizing the importance of avoiding these pitfalls and staying true to our SES framework, we focus energy on program- and student-level engagement that supports long-term, multifaceted, and reciprocal relationships. This is a significant challenge, especially because we are only physically present in the system for two weeks out of the year. However, we recognize that for research to be most useful to communities, it needs to be coproduced [49]. In other words, research is more likely to influence action or have impact within communities if it is produced with community members. Further, co-production helps to ward off potentially negative impacts of research *on* versus *with* community. In the sections below, we describe our program- and student-level engagement with community and our current strategies for co-producing knowledge with community.

a.　Program-Level Engagement within the SES

Our course has two primary community partners, staff and collaborators at Gobabeb and local members of the Topnaar community (Boxes 1 and 2). Prior to the first year, we worked to build relationships with Gobabeb and in the Topnaar community through in-person meetings and visits to individual Topnaar settlements and the leader of the Topnaar Traditional Authority (TTA), Chief Seth Kooitjie; this helped us understand the local power structures, engage with different kinds of community leaders, and to identify potential boundary spanners [50] or beach head leaders [51]. These boundary spanners have proved critical as initial points of engagement with these different social groups within the SES.

Box 1. Questions and answers with Joseph Tjitekulu.

Joseph is a community activist focusing on development of rural communities in such as the Topnaar Traditional community. He has also been employed by the Topnaar Traditonal Authority and by Gobabeb as a liaison to the Topnaar community. In the latter capacity, he facilitated student research by arranging interviews with community members and serving as an interpreter.

Q: Have the community members that have interacted with our students had generally positive personal interactions with them?

A: Yes, it was evident because the respondents sat through 20 questions, etc. Members of the community do get frustrated by being asked questions by people from various government ministries as well as researchers that come through Gobabeb. They are sometimes reluctant to interact because they don't see results of the assessments or interviews conducted. They don't understand research. The information that has come from this research is good for the Topnaar leadership structure and it is good for planning purposes, but for community members it is a bit advanced. They don't see the distinction between research and development work. Perceptions are usually taken up wrongly. The community feels that once it is discussed, "I should eat the fruit by the end of the day". We need to do a better job of communicating from the start that this is not development work.

Box 1. *Cont.*

The community members have appreciated the tea and sugar you have given as a token of appreciation. As well as how you have supported our students with bursaries.

Q: How can we do better at communicating our purpose and our findings?

A: We shouldn't have centralized information sharing. It should be decentralized; "bring the baby to the mothers". We need to go to the settlements to present the findings. Also, we need to adjust the information to target development. We can slap two flies with one clap. Present the information in the same fashion that it was gathered. And communicate it in Afrikaans as well as English. Then those in the community can see what has been done and think, "I can build on this". Let's make a smaller, illustrated report. Just one page. Perhaps a short video.

Q: When we say we're from Dartmouth, do you think people remember us from year to year? Or see us differently from Gobabeb?

A: No. They see you as Gobabeb. The leadership knows Dartmouth, but not most in the community. You need to wear your identity on your bodies. T-shirts and ball caps. We need decentralized information sharing about Dartmouth. Publicize bursaries and other activities.

Q: Do you think that our work with Gobabeb and the Topnaar has impacted your relationship with each other, for good or bad? If so, in what ways?

A: It's not a one-night stand that will change the Gobabeb-Topnaar relationship. It is difficult. We need to revamp the whole information sharing process. We need to get them together. Have some drama plays to convey useful information. I'm an advocate of having these meetings outside Gobabeb. Because it is in the community where implementation of these ideas would take place.

Q: As we think about future projects, what would you like to see us work on? Any important considerations we should think about when working on those projects?

A: Help us create a database of the community. Create a living document that could be updated frequently on the state of the community.

Investigate water extraction from the !Khuiseb aquifer by Namwater. Namwater have developed new boreholes in the lower delta and are planning for more in the upper !Khuiseb. How does it affect fodder production by the riparian trees? Livestock health used to be better. There was more grass and trees.

Develop environmental education for adult learners in the community. A small course of 3-5 days communicated at the right level for the community.

Box 2. Questions and answers with Gillian Maggs-Kölling.

Dr. Maggs-Kölling has served as executive director of Gobabeb for five years. Her formal training is as a botanist.

Q: You host various teaching and research groups here at Gobabeb. What if any differences or benefits do you see from us coming here to "enter the SES" as opposed to a more traditional course?

A: You come here as a partner and that has made a big difference; you've been very responsive to our interests and needs. We've enjoyed seeing how the research has evolved and moved toward areas of mutual interest. And you've helped advise and support our young scientific staff.

Working with your students in this way has made me realize that some of the young people from abroad, who come with other programs to Gobabeb, miss an important part of the experience since they don't interact as extensively with our staff as your students do.

I think the collaborative aspect of this has been particularly important to our young emerging Namibian scientists. The fact that they see their work with you and your students as a collaboration has opened space for their ownership of the research and that has led to greater commitment on their part. The staff also appreciate how you give back to Gobabeb and the Topnaar community.

Q: Has our course had any impact on Gobabeb's relationship with the Topnaar Community?

A: We've been working hard on our relationship and I think it's getting better. I think the Dartmouth course has helped us to increase our engagement and create more productive interactions with members of the community. With Dartmouth's impetus we have moved into research areas that have the potential to benefit the community, in particular the research on livestock. This is outside the norm for Gobabeb, working on agricultural issues, but we think it has great potential to be helpful to members of the Topnaar community. The Topnaar are our neighbors and we want to work together with them. Personally, I would like Gobabeb to be able make a change in the lives of people in the community, especially, those that don't have much of a voice or many economic options. Topnaar are a stakeholder in what we do and they feature in our strategic planning. We want to find out with them what are their needs for research, what are their questions? How can we partner with them to help answer the questions?

Box 2. *Cont.*

> But we do not have expertise or capacity to do development work. Our signature strength is in research, broadly defined. Desert Ecology and atmospheric science are where we have made our most prominent contributions. But we know it's not good enough to just produce peer reviewed articles.
>
> But there are challenges and constraints on both sides. I think there is a good deal of misunderstanding and mistrust. I see a mismatch between what the community wants from us and what we, as a research institution, can provide. We get discouraged when we hear that some in the community think we want to exploit their traditional knowledge. Those kind of tensions sometimes discourage young Namibian researchers from working on !nara or other things relating to the Topnaar. We're also stretched thin because we bear responsibility to all of Namibia not just our Topnaar neighbors.

Each partner is unique, and engaging with either of them has certain complexities. One of the challenges of engaging with any community is that no community is a unitary entity. Engaging with Gobabeb has been comparatively straight-forward when compared to engaging with the Topnaar because of the shared western academic and research culture and our proximity; we stay on-site at Gobabeb. Staff and visitors include Namibian, South African, European, and American researchers, students, and interns. Leadership and staff at Gobabeb have also been relatively constant during our time at the Centre, creating continuity. Co-author and Executive Director at Gobabeb, Gillian Maggs-Kölling, has been our primary contact for the last five years, and several Gobabeb scientists have worked with the program consistently for at least two years in a row (Box 2).

In contrast, although we often visit Topnaar villages while interacting with the community, we spend much less time there than at Gobabeb. As we had anticipated, building a relationship with the Topnaar community has been a more gradual process. Gulfs of language, history, culture, and perceptions of unequal power and affluence are some of the complexities. We started out with the intention of creating a constructive and mutually beneficial relationship between our course and any members of the Topnaar community that were interested in engaging with us. We first secured permission of TTA leader, Chief Seth Kooitjie, by meeting with him to explain our intentions. We meet with the Chief annually when we return to Namibia, and we also deliver copies of the student papers from the previous year. In 2017, we developed an agreement between the TTA and our program about research on Topnaar indigenous knowledge systems. This agreement was a critical step in formalizing our relationship. Over time we have developed relationships with other community members, including Topnaar students at the local primary school, the local agricultural extension agent, members of Chief Kooitjie's staff, and Topnaar members of the Gobabeb staff (Box 1).

Because, essentially, the same core group of Dartmouth faculty and staff return annually, social capital has developed among the Dartmouth personnel, Gobabeb staff, and the local Topnaar community members. Logistically, the long-term relationship means that the course can run more smoothly and efficiently. Academically, returning to the same site has allowed for us to develop research projects that build on each other to achieve more depth, and eventually, contribute to the academic literature. Interpersonally, the long-term relationship demonstrates a commitment to our community partners and a commitment from them to us to do good work together. Now that relationships are established, each year is a reunion versus a first encounter, eliminating much of the introductory relationship building efforts. Although, each year new relationships are formed as well. In addition, our established relationships mean that each partner has a deeper understanding of how to work together, and is familiar with customs and communication patterns, which facilitates the production of higher quality, in-depth work.

b.   Student-Level Engagement within the SES

Some of the most valuable learning happens as students try to envisage themselves as members of this SES and to navigate the social dynamics. These relationships bring up some difficult issues for students, who often question the validity of our presence and our approach. Most students on the program are familiar with critiques of western development efforts and some struggle with feelings

of being "just another western expert dropping in, doing work, and leaving". During the program, we emphasize that students are part of the community, and are also part of building a long-term, reciprocal relationship among SES members. Nonetheless, they sometimes struggle to see this as a reciprocal relationship because they feel privileged to have learned from the Topnaar and often feel that they receive more than we give. Typically, when members of their community engage with the students in research, we present them with small gifts as tokens of appreciation (i.e., a basket of food/kitchen items). We have to remind the students to think of reciprocity in a broader time frame and in relation to different forms of exchange [18], not just this initial exchange. In effect, we have created a relationship through time. Although most individual students spend only 15 days engaged with these communities, our program stays engaged across the years. While individual students may just be "dropping in", the program is engaged as a long-term partner. Students also do not always appreciate that some members of the community value the time and effort that the students invest in the relationship. In addition, exchange between partners can occur in a number of ways, such as sharing song, stories, knowledge, resources, and time. These are all valuable forms of exchange, and, as Maiter et al. [18] remind us, we cannot expect all exchange to be perfectly symmetrical, nor are all the parties likely to assign the same value to different forms of exchange.

4. Discussion

As our reflections illustrate, designing a real-world field-course based in community is fraught with challenges and nuances that are rarely encountered in on-campus courses. Yet, we have found these challenges are also necessary for learning and growth and are what make the experience transformative. Although we have not completed a formal assessment of learning outcomes, students have responded enthusiastically to the new course and course evaluations have been strong. Although we have much still to learn, here we conclude with some of our subjective impressions, tentative conclusions, and our next steps for further improvement.

In our experience, the SES/CBR framing helped us to navigate our primary pedagogic challenges. These concepts helped incorporate the diverse interests of our interdisciplinary students and worked in the intercultural context of American university students studying in Namibia. We found that both the SES and CBR frameworks could be communicated easily to students, but both were also rich springboards for reflection and skills acquisition (Figure 1). For example, both of the framings encourage students to ask questions about interconnectedness in the system and to explore their roles, responsibilities, and influences. By viewing ourselves as part of the SES and with the guidance of the CBR literature, we were better able to articulate our ethical position and council students on their ethical dilemmas. Further, this framing and thoughtful consideration of ethics, communication and collaboration have helped to develop processes and approaches that productively engage community partners with the goal of mutual benefit. Although still challenging, using research as the primary learning activity lends itself to students connecting their work with the broader theory and empiricism they learn on campus and fostered a level of ownership of their work and ideas.

Although the content of our course aligns best with environmental studies, or similar fields, we feel that some of our lessons learned have broad applicability to other "real-world" courses. These include the need to provide a clear framing for the course that helps students to understand their position in the system under consideration. Similarly, the need to connect student's real-world experiences with the theory and broader empiricism of on-campus instruction seems nearly universal. We think that the SES framing could be useful to other real-world courses in which the primary orientation is interdisciplinary. Furthermore, courses and real-world settings in which social justice issues play a role may also find useful the avoidance of "problem" and "service" in this framing. These concepts might be less useful in courses with a primarily disciplinary approach or where a "problem-solving" frame is intrinsic, such as engineering or human health.

We recognize that some aspects of our course are unique. Many programs occur over longer periods of time (e.g., semester) and that most classes will not have been living and working together

for the preceding 3–6 weeks. While the practices that are suggested in this paper may still apply, how they are enacted or carried out will inevitably be different. For example, professors will need to consider the burn-out of students over a longer period of time and how to deal with unexpected illness or relationship challenges that are more likely to emerge over a semester than during 15 days. Approaches to helping students deal with conflict management, for example, may need to be adapted.

In addition, resources, financial and human, have been essential to the conduct of this course. Clearly, this type of course requires far greater human resources than an on-campus lecture course. This seems unavoidable and essential to this type of endeavor. We are in the enviable position of having not only the resources of a typical Dartmouth course, but also two endowments from the families of past students of the program, one of which is specifically targeted to this course. This is an important consideration for the generality of our findings. However, while this degree of resource availability is necessary for funding a course in a distant overseas location, the requirements should be much less for a domestic course of similar structure.

In ongoing conversations with some of our key community partners (e.g., Box 1 and 2), we have learned about community perceptions of our program and have gained ideas for future research projects. Given our shared interests in research our interactions with Gobabeb staff have generally been viewed positively and mutually beneficial (Box 2). While we have successfully engaged with the Topnaar leadership, our engagement with the broader Topnaar community is not as deep and more episodic. Although research shows that community members do not always desire to be involved in all stages of the research process [52], and researchers are not always able to involve community members throughout the research process, we aim to provide opportunities for engagement throughout the research cycle, at a level that works for all parties. Our experiences to date indicate that we need to work harder on this aspiration (Box 1). For example, in prior years, members of the Topnaar have contributed data during the data collection stage, but they have not been as involved in project development, research design, or the development of recommendations or implementation of those recommendations. To stay true to the principles of CBR, we need to at least explore, and ideally, facilitate greater involvement in the entire research process.

Interestingly, perhaps due to cultural similarities, and because we spend substantial time with Gobabeb staff, students often have difficulty conceiving of Gobabeb and its staff as part of the community or as a unique component of the SES. They sometimes speak and act as if the term only applies to Topnaar community members. Students' perceptions, at times, have colored their research interpretations. For example, when students have focused on Gobabeb's relationship with the Topnaar, they have sometimes taken sides with the Topnaar, rather than neutrally analyzing the relationship. This is an issue with which we continue to grapple and are taking a reflective approach, examining, among other things, how we explain community.

Another area for continuing work is in communicating research results back to our partners, particularly with our Topnaar partners (Box 1). Each year members of the TTA have attended the student presentations along with Gobabeb staff. Annually, we return with edited and printed papers from the previous year's work and present them to Chief Kooitije and other partners. These presentations and written documents are useful for our Gobabeb partners, but may be of less use in the broader Topnaar community (Box 1). We plan to experiment with other means of communication suggested by community partners (Box 1). This coming year we plan to have each student group prepare and distribute a single-page, graphics-heavy presentation of their results with text in Afrikaans or Khoekhoegowab (languages widely spoken in the Topnaar community).

There have been a number of unanticipated and gratifying outcomes of this course. We have been surprised by how much our engagement has grown and diversified in just five years. We realize now that what we have begun is much more organic than a typical course and it has taken on a life of its own. The research has diversified from an initial emphasis on !nara biology and Topnaar use of !nara to include new dimensions including Topnaar pastoral ecology, interactions of Topnaar livestock with !nara, and environmental education. In November 2016, we began a long-term herbivore

exclusion experiment to examine the effect of browsing by Topnaar livestock on !nara productivity. This experiment requires year-round collaboration to accomplish monthly monitoring and data collection and visits by Dartmouth faculty outside of the course period.

Despite continuing limitations (Box 1), our engagement with the Gobabeb and Topnaar communities has grown. Since the program began, Gobabeb created a two-year, grant-funded staff position for a Topnaar liaison from the community and we have interacted with this person extensively during his tenure. There has been increasing engagement by the Topnaar community in determining research priorities (Box 1). During the 2016 course, students conducted interviews with 25 Topnaar households to discuss livelihood activities and the desire for development support in areas of community tourism, livestock husbandry, and other activities. These results indicated that livestock husbandry was a priority. Consequently, we and Gobabeb have initiated several lines of livestock research. Three students have returned to Gobabeb to continue research that was begun while participating in the program. That has always been an aspiration and we continue to look for ways to increase the frequency of return visits. We have helped to support and mentor several Topnaar students, as well as supporting Namibian masters students to work on research projects on livestock and !nara. Out initial hope was that over time we could "grow" productive relationships with our partners and that is happening. Continued monitoring of study sites between Dartmouth visits is undertaken by Gobabeb, according to agreed protocols and schedules. This has ensured local ownership of the research (Box 2) that is now integrated in the routine long-term monitoring agenda of the Centre.

Despite these relationship-building and collaborative research efforts, we are still, quite literally, oceans apart, and our time together as a community of academics, practitioners, and community members is limited. We are still figuring out how to engage in ethical and effective community-based participatory research given these constraints. One of our key lessons has been that we cannot let these constraints stop us from trying. Our hopeful perception of the experience of the past five years has been that facilitating students entering a social-ecological system in this manner allows them to develop the persistence, adaptability, humility, willingness to take risks, and desire to connect with other humans that are necessary to address pressing sustainability problems that affect us all.

References

1. Clark, W.C.; Van Kerkhoff, L.; Lebel, L.; Gallopin, G.C. Crafting usable knowledge for sustainable development. *Proc. Natl. Acad. Sci. USA* **2016**, *113*, 4570–4578. [CrossRef] [PubMed]
2. Hart, D.D.; Bell, K.P.; Lindenfeld, L.A.; Jain, S.; Johnson, T.R.; Ranco, D.; McGill, B. Strengthening the role of universities in addressing sustainability challenges: The Mitchell Center For Sustainability Solutions as an institutional experiment. *Ecol. Soc.* **2015**, *20*. [CrossRef]
3. Brundiers, K.; Wiek, A.; Redman, C.L. Real-world learning opportunities in sustainability: From classroom into the real world. *Int. J. Sustain. High. Educ.* **2010**, *11*, 308–324. [CrossRef]
4. Clark, S.G.; Steen-Adams, M.M.; Pfirman, S.; Wallace, R.L. Professional development of interdisciplinary environmental scholars. *J. Environ. Stud. Sci.* **2011**, *1*, 99–113. [CrossRef]

5. Lozano, R.; Merrill, M.; Sammalisto, K.; Ceulemans, K.; Lozano, F. Connecting Competences and Pedagogical Approaches for Sustainable Development in Higher Education: A Literature Review and Framework Proposal. *Sustainability* **2017**, *9*, 1889. [CrossRef]

6. Cooke, S.J.; Vermaire, J.C. Environmental studies and environmental science today: Inevitable mission creep and integration in action-oriented transdisciplinary areas of inquiry, training and practice. *J. Environ. Stud. Sci.* **2015**, *5*, 70–78. [CrossRef]

7. Keen, C.; Baldwin, E. Students promoting economic development and environmental sustainability. *Int. J. Sustain. High. Educ.* **2004**, *5*, 384–394. [CrossRef]

8. Brundiers, K.; Wiek, A. Beyond Interpersonal Competence: Teaching and Learning Professional Skills in Sustainability. *Educ. Sci.* **2017**, *7*, 39. [CrossRef]

9. Wiek, A.; Kay, B. Learning while transforming: Solution-oriented learning for urban sustainability in Phoenix, Arizona. *Curr. Opin. Environ. Sustain.* **2015**, *16*, 29–36. [CrossRef]

10. Wiek, A.; Xiong, A.; Brundiers, K.; van der Leeuw, S. Integrating problem- and project-based learning into sustainability programs. *Int. J. Sustain. High. Educ.* **2014**, *15*, 431–449. [CrossRef]

11. Kolb, A.Y.; Kolb, D.A. Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education. *Manag. Learn.* **2005**, *4*, 193–212. [CrossRef]

12. Kinahan, J. No need to hear your voice, when I can talk about you better than you can speak about yourself...' Discourses on Knowledge and Power in the !Khuiseb Delta on the Namib Coast, 1780–2016 CE *Int. J. Hist. Archaeol.* **2017**, *21*, 295–320. [CrossRef]

13. Dieckmann, U.; Odendaal, W.; Tarr, J.; Schreij, A. *Indigenous Peoples and Climate Change in Africa: Report on Case Studies of Namibia's Topnaar and Hai‖om Communities*; Legal Assistance Centre: Windhoek, Namibia, 2013.

14. Creswell, J.W. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 2nd ed.; SAGE Publications Inc.: New York, NY, USA, 2003.

15. Foster, K.; McAllister, M.; O'Brien, L. Extending the boundaries: Autoethnography as an emergent method in mental health nursing research. *Int. J. Ment. Health Nurs.* **2006**, *15*, 44–53. [CrossRef] [PubMed]

16. Chaves, M.; Macintyre, T.; Verschoor, G.; Wals, A.E.J. Towards transgressive learning through ontological politics: Answering the "call of the mountain" in a Colombian network of sustainability. *Sustainability* **2017**, *9*, 21. [CrossRef]

17. Trahar, S. Beyond the Story Itself: Narrative Inquiry and Autoethnography in Intercultural Research in Higher Education. *Forum Qual. Soc. Res.* **2009**, *10*, 30.

18. Maiter, S.; Simich, L.; Jacobson, N.; Wise, J. Reciprocity: An ethic for community-based participatory action research. *Action Res.* **2008**, *6*, 305–325. [CrossRef]

19. Bruner, J. *The Process of Education*; Harvard University Press: Cambridge, MA, USA, 1960.

20. Kaner, S. *Facilitator's Guide to Participatory Decision-Making*, 3rd ed.; Jossey-Bass: San Francisco, CA, USA, 2014.

21. Orzel, C. Why Research by Undergraduates Is Important for Science and Students. Available online: https://www.forbes.com/sites/chadorzel/2017/07/12/why-research-by-undergraduates-is-important-for-science-and-students/#83bb5ee29a08 (accessed on 18 July 2018).

22. Hunter, A.; Laursen, S.L.; Seymour, E. Becoming a scientist: The role of undergraduate research in students' cognitive, personal, and professional development. *Sci. Educ.* **2007**, *91*, 36–74. [CrossRef]

23. Symes, L.B.; Serrell, N.; Ayres, M.P. A Practical Guide for Mentoring Scientific Inquiry. *Bull. Ecol. Soc. Am.* **2015**, *96*, 352–367. [CrossRef]

24. Mogk, D.W.; Goodwin, C. Learning in the field: Synthesis of research on thinking and learning in the geosciences. *Earth Mind II A Synth. Res. Think. Learn. Geosci.* **2012**, *486*, 131–161. [CrossRef]

25. Ernst, C.M.; Buddle, C.M.; Soluk, L. The Value of Introducing Natural History Field Research into Undergraduate Curricula: A Case Study. *Biosci. Educ.* **2015**, *7860*. [CrossRef]

26. Stocking, V.B.; Cutforth, N. Managing the Challenges of Teaching Community-Based Research Courses: Insights from Two Instructors. *Mich. J. Community Serv. Learn.* **2006**, *13*, 56–65.

27. Lichtenstein, G.; Thorme, T.; Cutforth, N.; Tombari, M.L. Development of a National Survey to Assess Student Learning Outcomes of Community-Based Research. *J. High. Educ. Outreach Engagem.* **2011**, *15*, 7–29.

28. *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*; Berkes, F.; Folke, C. (Eds.) Cambridge University Press: New York, NY, USA, 1998.

29. Ostrom, E. A diagnostic approach for going beyond panaceas. *Proc. Natl. Acad. Sci. USA* **2007**, *104*, 15181–15187. [CrossRef] [PubMed]

30. Folke, C.; Carpenter, S.R.; Walker, B.; Scheffer, M.; Chapin, T.; Rockström, J. Resilience thinking: Integrating resilience, adaptability and transformability. *Ecol. Soc.* **2010**, *15*, 20. [CrossRef]

31. Binder, C.R.; Bots, P.W.G.; Hinkel, J.; Pahl-Wostl, C. Comparison of Frameworks for Analyzing Social-ecological Systems. *Ecol. Soc.* **2013**, *18*, 26. [CrossRef]

32. Flicker, S.; Travers, R.; Guta, A.; McDonald, S.; Meagher, A. Ethical dilemmas in community-based participatory research: Recommendations for institutional review boards. *J. Urban Health* **2007**, *84*, 478–493. [CrossRef] [PubMed]

33. Minkler, M. Ethical challenges for the "outside" researcher in community-based participatory research. *Health Educ. Behav.* **2004**, *31*, 684–697. [CrossRef] [PubMed]

34. Israel, B.A.; Schulz, A.J.; Parker, E.A.; Becker, A.B. REVIEW OF COMMUNITY-BASED RESEARCH: Assessing Partnership Approaches to Improve Public Health. *Annu. Rev. Public Health* **1998**, *19*, 173–202. [CrossRef] [PubMed]

35. Nyden, P. The Challenges and Opportunities of Engaged Scholarship. Available online: https://compact. org/resource-posts/the-challenges-and-opportunities-of-engaged-research/ (accessed on 18 July 2018).

36. D'Alonzo, K.T. Getting started in CBPR: Lessons in building community partnerships for new researchers. *Nurs. Inq.* **2010**, *17*, 282–288. [CrossRef] [PubMed]

37. Silka, L.; Renault-Caragianes, P. Community-University Research Partnerships: Devising a Model for Ethical Engagement. *J. High. Educ. Outreach Engagem.* **2007**, *11*, 171–183.

38. Thomas, K.W.; Kilmann, R.H. *The Thomas-Kilmann Conflict Mode Instrument*; CPP Inc.: Mountain View, CA, USA, 1974; pp. 155–174.

39. Townsend, B.K.; Newell, L.J.; Wiese, M.D. *Creating Distinctiveness: Lessons from Uncommon Colleges and Universities*; The George Washington University: Washington, DC, USA, 1992.

40. Thompson, S.K.; Neill, C.J.; Wiederhoeft, E.; Cotner, S. A Model for a Course-Based Undergraduate Research Experience (CURE) in a Field Setting. *J. Microbiol. Biol. Educ.* **2016**, *17*, 469–471. [CrossRef] [PubMed]

41. Bell, R.; Smetana, L.; Binns, I. Simplifying inquiry instruction. *Sci. Teach.* **2005**, *72*, 30–33.

42. Lambrechts, W.; Mulà, I.; Ceulemans, K.; Molderez, I.; Gaeremynck, V. The integration of competences for sustainable development in higher education: An analysis of bachelor programs in management. *J. Clean. Prod.* **2013**, *48*, 65–73. [CrossRef]

43. Ban, N.C.; Boyd, E.; Cox, M.; Meek, C.L.; Schoon, M.; Villamayor-Tomas, S. Linking Classroom Learning and Research to Advance Ideas about Social-Ecological Resilience. *Ecol. Soc.* **2015**, *20*. [CrossRef]

44. Hancock, C.; Storey, A.; Downing, J.; Szewczak, S.M. Interagency Resource Teams: A Model for Collaborative Approaches to Environmental Education. *Conserv. Biol.* **2001**, *15*, 596–602. [CrossRef]

45. Hatcher, J. a.; Bringle, R.G.; Muthiah, R. Designing Effective Reflection: What Matters to Service-Learning? *Mich. J. Community Serv. Learn.* **2004**, *11*, 38–46.

46. Pasque, P.; Smerek, R.; Dwyer, B. *Higher Education Collaboratives for Community Engagement and Improvement*; National Forum on Higher Education for the Public Good: Ann Arbor, MI, USA, 2005.

47. Hodge, F.S.; Weinmann, S.; Roubideaux, Y. Recruitment of American Indians and Alaska Natives Into Clinical Trials The American Indian And Alaska. *Ann. Epidemiol.* **2000**, *2797*, S41–S48. [CrossRef]

48. Silka, L. Paradoxes of partnership: Reflections on university-community. In *Research in Politics and Society: Community Politics and Policies*; Kleniewski, N., Rabrenovic, G., Eds.; JAI Press: Stamford, CT, USA, 1999; pp. 335–359.

49. Clark, W.C.; Dickson, N.M. Sustainability science: The emerging research program. *Proc. Natl. Acad. Sci. USA* **2003**, *100*, 8086–8091. [CrossRef] [PubMed]

50. Leifer, R.; Delbecq, A. Organizational/ Environmental Interchange: A Model of Boundary Spanning Activity. *Acad. Manag. Rev.* **1978**, *3*, 40–50. [CrossRef]

51. Hoverman, S.; Ross, H.; Chan, T.; Powell, B. Social Learning through Participatory Integrated Catchment Risk Assessment in the Solomon Islands. *Ecol. Soc.* **2011**, *16*. [CrossRef]

52. Bieluch, K.H.; Bell, K.P.; Teisl, M.F.; Lindenfeld, L.A.; Leahy, J.; Silka, L. Transdisciplinary research partnerships in sustainability science: An examination of stakeholder participation preferences. *Sustain. Sci.* **2016**, *12*, 87–104. [CrossRef]