The Sustainable Human and Environmental Systems (SHES) Approach to Sustainability Education and Practice: The Pedagogical Challenge

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Abstract: The Sustainable Human and Environmental Systems (SHES) approach to sustainability education and practice embraces the education of students, practitioners, and whole societies as a prerequisite for transforming unsustainable societies into sustainable ones. It is suitable for use not only with students who are enrolled in academic or pre-professional courses and programs in colleges and universities large and small but also by practitioners in the field. The SHES approach is also inherently well suited for use across a full spectrum of courses and programs—not just in stand-alone "sustainability" courses and programs but also in others as a complement to content defined by reference to discipline-dependent criteria, such as in environmental science or studies, political science or sociology, ethics, or business administration. The signature feature of the SHES approach to sustainability education and practice is the use of holistic thinking (especially but not exclusively systems thinking) to reveal complexity holistically in a stepwise fashion as an alternative to the use of reductionist thinking (especially but not exclusively discipline-dependent thinking, including interdisciplinary thinking) to engage in analysis. Yet the SHES approach is not just a conception of sustainability education. It is also a cognitive strategy—in two senses. First, it is cognitive strategy for acquiring essential competencies through the use of certain holistic thinking strategies in the context of the steps of the SHES approach. Second, it is a cognitive strategy for diagnosing, prescribing, and implementing sustainable responses to the challenges posed by situations that are inconsistent with a sustainable society. The steps of the SHES approach as a cognitive strategy may be depicted in either of two ways. First, they may be depicted as a sequence of steps applied recursively as each situation of concern in a society is transformed into a sustainable alternative. Second, they may be depicted as a non-recursive sequence applied to all situations of concern in a society in the aggregate, without regard to the relative timing of the transformation of each situation. In either case, the SHES approach regards ten competencies as essential: holistic thinking; systems thinking; supradisciplinary thinking; complexity thinking; future thinking; adaptive thinking; diversity thinking; collaboration; stakeholder engagement; and project planning, implementation, and outcomes evaluation. The SHES approach also regards certain pedagogical strategies as essential to enabling students to acquire these competencies: competency-based education (if properly conceived and implemented), backward design, the flipped classroom, and project-based learning.

Keywords: Cognition, competencies, pedagogy, sustainability education.

Introduction

T he Sustainable Human and Environmental Systems (SHES) approach to sustainability education and practice is a living set of recommendations concerning the pedagogy and administration of interdisciplinary and higher-order, sustainability-focused degree programs in higher education and their implications for sustainability practice. It embraces the education of students, practitioners, and whole societies as a prerequisite for transforming unsustainable societies into sustainable ones (cf. Focht & Barresi 2019, p. 62 [1]). The Sustainable Human and Environmental Systems (SHES) approach to sustainability education and practice is the work of the SHES Roundtable. Since 2009, the SHES Roundtable has been a collaborative forum for college and university faculty and administrators, practitioners, and others from throughout North America and beyond to pursue their commitment to providing students in higher education with the knowledge and skills needed by practitioners and whole societies to meet the existential sustainability challenges that plague the modern world (see, e.g., Focht, Reiter, Barresi & Smardon, 2019 [2]).[1]

Almost from the start, the Roundtable intended the SHES approach to sustainability education and practice to be universally applicable, regardless of institutional setting or subject matter context (see Reiter et al., 2011, pp. 61, 66, 70, 73 [3]; Reiter et al., 2012, pp. 109, 113, 116 [4]; Reiter & Smardon, 2019, pp. 232, 236 [5]). As a result, the SHES approach is suitable for use not only with students who are enrolled in academic or pre-professional courses and programs in colleges and universities large and small but also by practitioners in the field. The SHES approach is also inherently well suited for use across a full spectrum of courses and programs—not just in stand-alone "sustainability" courses and programs but also in others as a complement to content defined by reference to discipline-dependent criteria, such as in environmental science or studies, political science or sociology, ethics, or business administration. Notwithstanding this complementarity, the SHES approach regards ten competencies as essential, regardless of the subject matter context.

The SHES Essential Competencies

As Figure 1 shows, the SHES essential competencies fall into three functional categories: Signature Competencies, Other Cognitive Competencies, and Other Competencies. The Signature Competencies, which are cognitive skills, are essential elements of the SHES approach

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[1] For more on the history of the SHES Roundtable, see the SHES article on *Foundational Thematic Principles* in this issue of the *OIDA International Journal of Sustainable Development*.

Figure 1: The competencies that the SHES approach to sustainability education and practice regards as essential

FUNCTIONAL CATEGORY	GENERAL TYPE	COMPETENCY
SIGNATURE COMPETENCIES	**Holistic Thinking**	Can identify how the complex relationships and interactions of the parts of a whole constitute the whole
	Systems Thinking	Can resolve a system conceptually into a network of interacting subsystems and can synthesize conceptually from a network of interacting systems a more inclusive supersystem
	Supradisciplinary Thinking	Can describe and can explain complex phenomena using neither discipline-dependent theories nor discipline-dependent methods
	Complexity Thinking	Can distinguish both qualitatively and quantitatively between more and less complex situations that are inconsistent with a sustainable society and between more and less sustainable alternatives to those situations
OTHER COGNITIVE COMPETENCIES	**Future Thinking**	Can envision alternative futures and pathways to those futures using both forecasting and backcasting
	Adaptive Thinking	Can envision an adaptive response to circumstances that have changed over time or differ from expected circumstances enough to require such a response
	Diversity Thinking	Can recognize different stakeholder values, related perspectives on well-being, and the need to resolve conflicts among related claims
OTHER COMPETENCIES	**Collaboration**	Can work inclusively on a team to accomplish a task
	Stakeholder Engagement	Can demonstrate the skills needed to engage stakeholders in ways that would move a society toward a sustainable future
	Project Planning, Implementation, and Outcomes Evaluation	Can contribute to planning, completing, and evaluating the outcomes of a project

Source: Adapted and expanded from Smardon, Barresi & Reiter, 2019, pp. 128–29 Table 8.1 [6].

to sustainability education and practice because they are explicit in its signature feature, which is the use of holistic thinking (especially but not exclusively systems thinking) to reveal complexity holistically in a stepwise fashion as an alternative to the use of reductionist thinking (especially but not exclusively discipline-dependent thinking, including interdisciplinary thinking) to engage in analysis. As this signature feature implies, the SHES approach is not just a conception of sustainability education. It is also a cognitive strategy. Like the Signature Competencies, the Other Cognitive Competencies are also cognitive skills. The Other Cognitive Competencies are essential elements of the SHES approach because they are implicit in its use as a cognitive strategy. The Other Competencies, unlike the competencies in the first two functional categories, are not cognitive skills but are essential elements of the SHES approach nonetheless because they are otherwise implicit in fundamental features of the approach such as the SHES strategic goal. The essence of the SHES strategic goal is to bring about and to sustain the types of social learning needed to sustain the viability of the human and environmental systems and system interactions on which the realization of the SHES vision depends. The SHES vision is a world of sustainable societies. Social learning in this context is a society-wide process in which individuals learn from each other and behave accordingly in ways calculated to transform unsustainable societies into sustainable ones and to maintain them as such (cf. Focht & Barresi, 2019, pp. 62–63 [2]).[2] As their functions make clear, all the SHES essential competencies have strategic implications, albeit especially cognitive ones.

The SHES Approach as a Cognitive Strategy

The SHES approach to sustainability education and practice is a cognitive strategy in two senses. First, it is cognitive strategy for acquiring essential competencies though the use of certain holistic thinking strategies in the context of the

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[2] For more on these and other fundamental features of the SHES approach, see the SHES article on *Foundational Thematic Principles* in this issue of the *OIDA International Journal of Sustainable Development*.

steps of the SHES approach. Second, it is a cognitive strategy for diagnosing, prescribing, and implementing sustainable responses to the challenges posed by situations that are inconsistent with a sustainable society. As a cognitive strategy in these two senses, the SHES approach to sustainability education and practice is for use both with students in the classroom and by practitioners in the field. The steps of the SHES approach as a cognitive strategy may be depicted in either of two ways. First, these steps may be depicted as a sequence applied recursively as each situation of concern in a society is transformed into a sustainable alternative. Second, the steps may be depicted as a non-recursive sequence applied to all situations of concern in a society in the aggregate, without regard to the relative timing of the transformation of each situation. These depictions of the SHES approach as a cognitive strategy differ only in how explicitly they address the timing issue. Figure 2 leaves that issue implicit by depicting the SHES approach as a non-recursive sequence of steps applied to all situations of concern within a society in the aggregate.

As Figure 2 shows, the SHES approach unfolds as a sequence of three stages—a diagnostic stage, a prescriptive stage, and an implementation stage. The diagnostic stage is about diagnosing the features that make situations of concern unsustainable because they are inconsistent with a sustainable society (see Focht & Barresi, 2019, p. 66 [1]). The prescriptive stage is about envisioning responses that will transform these unsustainable situations into sustainable ones (see Focht & Barresi, 2019, p. 73 [1]). The implementation stage is about implementing the prescriptions, thus confirming their efficacy (see Focht & Barresi, 2019, p. 75 [1]). Each of these

three stages unfolds as a sequence of phases, which could be parsed in various ways. In Figure 2, the initial phase is about confirming each situation of concern as an unsustainable situation (see Focht & Barresi, 2019, p. 66 [1]). The final phase is about confirming the transformation of each unsustainable situation into a sustainable alternative (cf. Focht & Barresi, 2019, p. 75 [1], describing the final task within the second to last phase). The phases between these endpoints are about four things. Three of them are about (1) envisioning a sustainable alternative to each unsustainable situation, (2) envisioning systemic interventions that would transform each unsustainable situation into a sustainable alternative, and (3) generating the system interactions needed to bring about this transformation (see Focht & Barresi, 2019, pp. 74, 75 [1]; cf. Focht & Barresi, 2019, p. 75 [1], describing a task within a phase). The other two phases are about revealing the *systemic* and *interactional complexity* of each unsustainable situation or its sustainable alternative (see Focht & Barresi, 2019, pp. 68, 74 Figure 5.2 (Phase II.B.) [1]; cf. Focht & Barresi, 2019, p. 75 [1], accidentally omitting any description of Phase II.B. and erroneously referring to Phase II.C. as Phase II.B.). *Systemic complexity* is a measure of the number and diversity of the systems that make a given phenomenon what it is (Focht & Barresi, 2019, p. 65 [1]). *Interactional complexity* is a measure of the number and diversity of interactions among those systems that make that phenomenon what it is (Focht & Barresi, 2019, p. 65 [1]). All the phases of the SHES approach must be operationalized as a series of tasks and subtasks, which may vary depending on the context (cf. Focht & Barresi, 2019, pp. 66–68, 69–73, 74–75, 75–76 [1], including Focht & Barresi, 2019, pp. 67 Figure 5.1, 74 Figure 5.2, 76 Figure 5.3 [1]). The goal of these tasks and subtasks is the emergence of a sustainable society in which social learning has enabled the members of the society to manifest a greater capacity for contributing to its sustainability than they did before it was sustainable (cf. Focht & Barresi, 2019, p. 77 [1], describing the final phase and task of the SHES approach in terms of social learning).

The signature feature of the SHES approach to sustainability education and practice is the use of holistic thinking (especially but not exclusively systems thinking) to reveal complexity holistically in a stepwise fashion as an alternative to the use of reductionist thinking (especially but not exclusively discipline-dependent thinking, including interdisciplinary thinking) to engage in analysis. As a cognitive strategy, the SHES approach entails the use of holistic, supradisciplinary thinking at every step of the way. Figure 2 lists the most crucial holistic thinking strategies—*robust framing*; *systems thinking*, including *systemic resolution* and *systemic synthesis*; and *backcasting*—next to the stages and phases in which they play pivotal roles. *Robust framing* is the self-conscious conceptualization of a situation of concern or sustainable alternative to an unsustainable situation in a way that is robust enough to encompass all its crucial complexity, at least implicitly (see Barresi, 2019, p. 104 [7]). Systemic synthesis and systemic resolution are both *systems thinking* strategies. *Systems thinking* includes any mode of thinking that seeks to generate a holistic understanding of any phenomenon by conceptualizing it in terms of systems and interactions among those systems (Focht & Barresi, 2019, p. 64 [1]). Thus, systems thinking need not rely either explicitly or implicitly on systems theory (Focht & Barresi, 2019, pp. 64–65 [1]).

Figure 2. The steps of the SHES approach to sustainability education and practice as a cognitive strategy for use with students in the classroom and by practitioners in the field

THE SHES APPROACH AS A COGNITIVE STRATEGY

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Stages	Phases	Situations of Concern	Crucial Holistic Thinking Strategies	Essential Competencies
I. Diagnosing the Sustainability Challenge	**I.A.** Confirming each situation of concern as an unsustainable situation		Robust framing	Holistic Thinking Supradisciplinary Thinking Diversity Thinking Collaboration Stakeholder Engagement Project Planning, Implementation, and Outcomes Evaluation
	I.B. Revealing the systemic and interactional complexity of each unsustainable situation		Systemic resolution Systemic synthesis	Systems Thinking Supradisciplinary Thinking Complexity Thinking Collaboration Stakeholder Engagement Project Planning, Implementation, and Outcomes Evaluation
II. Prescribing a Sustainable Response	**II.A.** Envisioning a sustainable alternative to each unsustainable situation		Backcasting Robust framing	Holistic Thinking Supradisciplinary Thinking Future Thinking Diversity Thinking Collaboration Stakeholder Engagement Project Planning, Implementation, and Outcomes Evaluation
	II.B. Revealing the systemic and interactional complexity of each sustainable alternative		Systemic resolution Systemic synthesis	Systems Thinking Supradisciplinary Thinking Complexity Thinking Collaboration Stakeholder Engagement Project Planning, Implementation, and Outcomes Evaluation
	II.C. Envisioning systemic interventions that would transform each unsustainable situation into its sustainable alternative		Backcasting Systemic resolution Systemic synthesis	Systems Thinking Supradisciplinary Thinking Adaptive Thinking Collaboration Stakeholder Engagement Project Planning, Implementation, and Outcomes Evaluation
III. Implementing the Prescription	**III.A.** Generating the system interactions needed to transform each unsustainable situation into its sustainable alternative		Systemic resolution Systemic synthesis	Systems Thinking Supradisciplinary Thinking Adaptive Thinking Collaboration Stakeholder Engagement Project Planning, Implementation, and Outcomes Evaluation
	III.B. Confirming the transformation of each unsustainable situation into its sustainable alternative		Systems thinking	Systems Thinking Supradisciplinary Thinking Diversity Thinking Collaboration Stakeholder Engagement Project Planning, Implementation, and Outcomes Evaluation

SUSTAINABLE SOCIETY

Source: Updated and expanded from Focht & Barresi, 2019, p. 78 Figure 5.4 [1].

Systemic resolution is the reconceptualization of a given system as a network of interacting subsystems, one or more of which then become the system or systems of interest (Barresi, 2019, p. 111 [7]; see also Barresi et al., 2015 [8]). *Systemic synthesis* is the reconceptualization of a given system as a subsystem in a network of interacting subsystems that together make up a supersystem, with one or more of the other subsystems, the supersystem, or both then becoming the system or systems of interest (Barresi, 2019, p. 111 [7]). *Backcasting* is an alternative to forecasting. Forecasting is a strategy for envisioning the future by extrapolating from present behaviors and trends. In general, *backcasting* starts with a vision of a desired future unconstrainted by present behaviors and trends, then works backward to the present to identify strategies for bringing that future into being (see Robinson, 1990 [9]). By maintaining a consistently holistic, supradisciplinary perspective in each of its stages and phases, the SHES approach to sustainability education and practice circumvents the barriers to success inherent in approaches to sustainability education or practice that rely on reductionist thinking, especially but not exclusively discipline-dependent thinking.

Figure 2 also lists the essential competencies that are implicated in each stage or phase of the SHES approach as a cognitive strategy. As Figure 2 shows, each stage or phase invokes at least some of the signature competencies of the SHES approach.

Pedagogical Strategies and the SHES Approach

The SHES approach to sustainability education and practice also regards certain pedagogical strategies as essential to enabling students to acquire the SHES essential competencies. As Figure 2 shows, the SHES approach unfolds as a sequence of stages and phases within those stages that require students to think in certain ways. Merely proceeding through this sequence of steps plays a pedagogically strategic role by helping students to develop the holistic habits of mind at the core of the SHES approach (cf., e.g., Barresi, 2019, pp. 104–05 [7]). The SHES approach regards other pedagogical strategies as essential in other ways. These strategies include *competency-based education* (if properly conceived and implemented), *backward design*, the *flipped classroom*, and *project-based learning*. The lead author's Introduction to Sustainability course—an undergraduate general education course designated Sustainability Studies (SST) 101—is an almost paradigmatic example of a course that incorporates all these pedagogical strategies. The lessons learned in nurturing this course through many iterations played a pivotal role in the emergence of the diagnostic and prescriptive stages of the SHES approach as a particular sequence of discrete phases (see Barresi, 2019, p. 103 [7]).

Competency-Based Education

Competency-based education is a relative newcomer to postsecondary education, although its roots in primary and secondary education stretch back much further (see Nodine, 2016 [10]). In competency-based education, students progress through and out of a given course or program by demonstrating that they have acquired the requisite competencies, which may be expressed in terms of either knowledge-based or skill-based learning outcomes. As a practical matter, these two types of outcomes are intertwined. A student cannot demonstrate the acquisition of knowledge without having acquired certain skills—even if those skills are merely reading, writing, and reasoning. Similarly, a student cannot demonstrate the acquisition of a skill without having acquired some knowledge about the substantive context in which the skill must be demonstrated. The SHES approach to sustainability education and practice is about preparing students to contribute in a meaningful way as practitioners and citizens alike to meeting the challenge of transforming unsustainable societies into sustainable ones. Students cannot do so if they merely understand this challenge but lack the skills to act on that understanding. The SHES essential competencies, which emphasize the acquisition of skills—mostly cognitive skills but also collaborative, stakeholder engagement, and project planning, implementation, and outcomes assessment skills—are designed to equip students with the competencies needed to take the requisite action. For that reason, competency-based education is an essential element of the SHES approach. By requiring students to demonstrate acquisition of the requisite skills as they move through and out of SHES courses and programs, competency-based education ensures that students emerge from those courses and programs prepared to contribute as both practitioners and citizens to the transformation of unsustainable societies into sustainable ones.

SST 101 is a competency-based course. For some years, it was structured as a two-track course. Track 1, which focused on the principal steps of the diagnostic stage of SHES approach, was for students taking the course for the first time. Track 2, which focused on the principal steps of the prescriptive stage, was for students taking the course for the second time. As of this writing, these two tracks are in the process of being spun off as separate stacked, upper-level courses—SST 301A and SST 301B. SST 301A is designed to focus only on the diagnostic stage of the SHES approach. SST 301B is designed to focus only on the prescriptive stage. The competencies for SST 301A, which are subject to certain institution-specific constraints on wording and length, are as follows: (1) "use holistic thinking to define the

scope of a situation of concern in an unsustainable society"; (2) " use holistic thinking to confirm that a situation of concern in a society is unsustainable"; and (3) " use systems thinking to reveal some crucial complexity of an unsustainable situation in a society." The competencies for SST 301B are as follows: (1) "use holistic thinking to define the scope of a response to an unsustainable situation in a society"; (2) "use holistic thinking to confirm that a response to an unsustainable situation is sustainable"; and (3) "use systems thinking to reveal crucial complexity of a response to an unsustainable situation."

Despite its appeal as a useful pedagogical strategy in the sustainability context, competency-based education is susceptible to both mischaracterization and misuse. One way of mischaracterizing it is as job-training, although there is nothing inherent in the pedagogy of competency-based education to require such a narrow focus. Nor would such a focus be of much use in the sustainability context, given the relative novelty, complexity, and dynamism of sustainability as a sole or complementary career path. Competency-based education is also susceptible to misuse as a means of industrializing the education process. In that guise, competency-based education merely functions as a means of recasting coherent courses of study as laundry lists, menus, or grab bags of discrete competencies, crafted to be so generalized, abstract, or otherwise unsophisticated that they can be mixed and matched by students across thematically disparate courses and programs like interchangeable parts. This misuse of competency-based education is arguably the ultimate in pedagogical reductionism. As such, it has no useful role to play in sustainability education because it flies in the face of the holism needed to provide students with the knowledge and skills needed by practitioners and whole societies to meet the existential sustainability challenges that plague the modern world, as in the SHES approach. If properly conceived and implemented, however, competency-based education is an essential element of that approach.

Backward Design

Backward design emerged in the 1990s as an approach to curriculum development at both the course and the program levels (see Wiggins & McTighe, 1998 [11]). In the forward design of courses, the choice of course materials, the structure of the syllabus, and other constituent elements of the course come first. In the forward design of programs, the choice of courses and course sequences, the choice of faculty, and other constituent elements of the program come first. In both settings, the articulation of competencies or other learning outcomes is the final step of the process. As a result, the content of those competencies or other learning outcomes is constrained by all the other course or program

design elements. In a course or program that is developed using backward design, the articulation of the competencies or other learning outcomes is the first step of the process. All other elements of the course or program design flow from the content of the competencies or other learning outcomes (cf., e.g., Reiter, Coggins & Howse, 2009 [12]). Any approach to sustainability education and practice that seeks to equip students with the knowledge and skills needed by practitioners and whole societies to meet the challenge of transforming unsustainable societies into sustainable ones is likely to benefit from backward design in the development of both courses and programs. As a pedagogical strategy, backward design is much more likely than forward design to result in courses and programs that focus like lasers on graduating students with the necessary competencies. If those courses and programs are competency-based, then backward design is likely to be even more effective in that regard.

SST 101, whether in its historical two-track form or its emerging upper-level, stacked course form, is the result of backward design. Its goals are to provide students with a hands-on introduction to certain steps of the SHES approach. All other course elements—from the reading assignments to the case study–based group activities that are at the core of the course—have been designed with that goal in mind.

The Flipped Classroom

The flipped classroom is a pedagogical strategy with a rich history at the secondary school level, which also has gained some traction in postsecondary education (see, e.g., Bergmann & Sams, 2012 [13]). In a traditionally structured classroom, class sessions are used primarily to provide students with information, often by means of a lecture. It is only after and outside class that students are asked to apply that information, albeit sometimes in a smaller class section that performs an auxiliary function, at least at the postsecondary level. A flipped classroom reverses the order of this process. Students acquire essential information on their own before and outside class, typically through readings of some kind. In class, they work with the instructor and each other to learn how to apply that information. The flipped classroom can be a very useful means of achieving both knowledge-based and skill-based course and program learning outcomes but especially those that are skill-based. As such, it is an essential element of the SHES approach, in which the essential competencies are skills.

SST 101 is organized as a sequence of group activities that take place in a flipped classroom. The first is an ungraded practice activity designed to familiarize students with the rhythm of the course and a version of an assessment rubric that a later activity will require them to use in a more sophisticated way. The rest of the course is a sequence of graded group activities, each of which corresponds to a step in the SHES approach. Each group activity starts with a reading assignment, which explains and illustrates the corresponding step. Then the students attend a tutorial in which the instructor shows them how to perform that step but in the context of a case study different from the one in which the students will be required to perform it. The students then try their hands at performing the step in the context of the other case study, with each group submitting one or more fill-in-the-blank deliverables that show the results of their work. Because SST 101 is an introductory course, the instructor has filled in some of the blanks of the deliverable(s) in advance to provide the students with more guidance in their own work. Each completed deliverable serves as a diagnostic tool that enables the instructor to evaluate which aspects of the step in the SHES strategy the students have grasped well and which aspects the students have not grasped well. The instructor also assigns each group a preliminary grade based on the quality of the deliverable(s) submitted. Each group activity culminates in a "presentation" by each group, which takes the form of an instructor-led Socratic dialogue that focuses on the weaknesses in the deliverable(s) submitted by the group. The purpose of this discussion is to help the students to improve their grasp of the corresponding step in the SHES strategy. The students' final group grade is based on how well they were able to demonstrate in this dialogue their ability to build on the aspects of the step in the SHES strategy that they already had grasped well to improve their grasp of the rest.

Project-Based Learning

Project-based learning is widely used in postsecondary education, including in sustainability contexts (see, e.g., Ab Wahid, Lee & Baharudin, 2020 [14]; Perrault & Albert, 2018 [15]). In this type of learning, students "learn by doing" by working on a practical project drawn from life for an extended period, typically in groups. In the process, students are required to deploy both knowledge and skills collaboratively in the service of the project goal. Project-based learning has three principal virtues in the context of the SHES approach to sustainability education and practice. First, it evokes many of the features of the settings in which SHES professionals are likely to work. Whether they work in the public, private for-profit, or private not-for-profit sectors pursuing sustainability goals of their own organizations or of third-party clients, the work of SHES professionals is likely to take the form of discrete projects, each of which has a beginning, a middle, and an end. Second, project-based learning requires social learning, which is the strategic goal of the SHES approach to sustainability education and practice.[3] Third, project-based learning is linked explicitly to the project planning, implementation, and outcomes assessment competency of the SHES approach. For all these reasons, project-based learning is an essential element of the SHES approach.

In SST 101, the setting for all group activities is a single case study in which students are immersed throughout the course. The setting for all the tutorials is a different case study. Most of the required readings use a third case study as a principal focus. All three case studies are historical case studies, which are especially useful vehicles for introducing students to the steps of the SHES approach as a cognitive strategy. Historical case studies typically have two features that make them especially useful in that setting. First, the facts of historical case studies tend to be much more firmly established than the facts of current ones. As a result, there is much less if any need for students to engage in outside research or to make educated guesses about the facts to perform the steps of the SHES approach as a cognitive strategy, thus reducing the potential for unproductive distractions. Second, from the perspective of any historical case study, the future includes now. The prescriptive stage of the SHES approach starts with *backcasting* (see Figure 2). The use of a historical unsustainable situation as the point of departure for backcasting a future sustainable alternative serves as a check on students' natural tendency to engage in forecasting instead of backcasting. If the students' purportedly backcasted future alternative to the historical situation merely looks like the present or likely near future, then the students most likely have engaged in forecasting, not backcasting.

Conclusion

The SHES approach to sustainability education and practice regards certain competencies as essential. Most of them are cognitive skills that are implicated in the SHES approach as a cognitive strategy for use both with students in the classroom and by practitioners in the field. The SHES approach also regards certain pedagogical strategies as essential. Competency-based education helps to ensure that students who emerge from SHES courses and programs are prepared to contribute as both practitioners and citizens to the transformation of unsustainable societies into sustainable ones.

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[3] For more on this foundational aspect of the SHES approach, see the SHES article on *Foundational Thematic Principles* in this issue of the *OIDA International Journal of Sustainable Development*.

Backward design is much more likely than forward design to result in courses and programs that focus like lasers on graduating students with the necessary competencies. The flipped classroom is a very useful means of achieving skill-based course and program learning outcomes such as the essential competencies of the SHES approach. Project-based learning evokes many of the features of the settings in which SHES professionals are likely to work. In the hands of skilled educators, all these strategies are likely to enhance the efforts of educators to transform students into practitioners and citizens who are able to contribute in a meaningful way to the realization of the SHES vision—a world of sustainable societies.

Acknowledgments

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