6-3 Pedagogies of sustainability education
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6-3-1 Introduction

What sort of real-world situations are likely to be faced by students who have completed a course in sustainability science? The answer to this question will show us the direction to be taken in the pedagogy of sustainability education. Pedagogy can be described simply as a "strategy of instruction." However, teaching, instruction and facilitation are sometimes discussed as distinct activities. In this section, we adopt the position that all three are necessary in sustainability education, and take a broad view of pedagogy as design that considers all the elements relevant to the praxis of teaching and learning. As far as space permits, we shall examine not just the ideas and content of sustainability education but also its methodologies, learners, teachers/facilitators, basic attitudes toward science and nature, and learning environment, while considering situations which the student is likely to encounter after completing a course in sustainability science.

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[COLUMN (*can go anywhere)]

What situations are students likely to be working in after completing a course in sustainability science? Let us consider a possible scenario.

An industrial cluster is invited to a large village which has low income but is nearly self-sufficient. Although this is a major project with the expected economic benefits of corporate tax revenues and job creation, there is strong disagreement in the village between supporters and opponents. A considerable amount of money is spent on infrastructure and maintenance for the proposed site—land usage, industrial water, waste water, road construction and so forth—and the village eventually takes on a modern appearance.

However, problems soon develop. The constant stream of heavy trucks pollutes the air with exhaust gases, traffic accidents increase, groundwater is polluted, and the waste incineration facility and landfill site for the ash produced cannot keep up with the growing population. In the new residential areas, the ground has begun to subside in places where the ground level had been built up.

Residents lose interest in their farm fields, and the village's elderly residents barely manage to dredge and maintain the agricultural water supply that had saved the villagers

from drought over hundreds of years. Even the rice planting is left to the elderly.

A plan is proposed to dam the river a long way upstream in order to secure industrial water and to meet the increased demand for electricity from the growing population in the surrounding area. However, this would require excavation in a residential district with compulsory resettlement. Some people also voice their fond memories of the river in the days when they could swim in it.

With the arrival of cheap imports from developing countries, followed by the global economic recession, factories cannot sell their products and some begin to close down. The population starts to decrease, as does the village's income. The newly opened elementary school remains, but after a few years the older elementary schools in the mountain villages close. The local government officials born in the baby-boomer generation give priority to securing their retirement funds and, hiding behind the excuse of financial difficulties while keeping government coffers untouched, they do nothing to support the new green tourism proposal intended to improve the village's prospects. The village festival had once flourished with the participation of local businesses but is now barely kept going by the elderly residents. The large supermarket, which had dealt a blow to the small village stores and shopping district, pulls out, forcing villagers to go to the neighboring town for some of their everyday goods.

Agricultural production becomes unstable, perhaps because of global warming. Whereas smaller typhoons used to bring welcome rain, now a few powerful typhoons strike, causing landslides and damaging crops.

Imagine that you have landed a job as a public official in the planning department of this village. Your colleagues sitting beside you have come through a conventional university education. You have received a degree in Sustainability Education. How does your education differ from that of your colleagues? How do you differ from your colleagues in terms of the abilities you possess and the activities that will be expected of you?

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6-3-2 Desirable abilities

Panoramic knowledge

In the previous section of this chapter, panoramic or holistic knowledge was seen as central to the ability to exercise detachment and place oneself in different positions. This ability demands constant monitoring of one's own thinking so as to maintain a

metacognitive, third-person perspective (Flavell 1976). Practical problem-solving exercises with students from other disciplines are a good way of implementing transformative learning (Mezirow 1991), which leads students to think reflectively.

Let us look at a few areas relevant to this. Firstly, consider the success of science studies in the 20th century. Science studies taught us that science is not neutral, and that scientific knowledge is knowledge verified through certain procedures within a particular scientific community. This knowledge does not necessarily state the truth; it is provisional and may be rewritten in the future. Science has also tended toward dualism and reductionism.

Sustainability education will ideally foster such an awareness in graduates, so that when presenting their own specialist knowledge they are possessed of the humility to recognize its presuppositions and limitations without rigidly adhering to it, and also the open-mindedness to accept and impartially compare opinions from other perspectives. In addition, they should come to readily understand that people have different sociocultural values, and that sometimes the agreed-upon and adopted method is not necessarily the one that is the most effective from a scientific or technological perspective.

Students will also have learned that attitudes toward nature are influenced by culture. For example, due to the influence of the creation story in the Bible's Book of Genesis, which describes the dominion over nature granted by God to man, the West has tended to view nature as a resource. Activities for a sustainable society include reflection on such views of nature, but ultimately regard humankind as an intrinsic part of nature and aspire to a society of harmonious coexistence. This sort of viewpoint can be learned by students together irrespective of their specialties, and may even be presented in the traditional form of knowledge transmission through lectures.

Skills

The previous section of this chapter cited communication skills, collaboration skills and problem-solving skills. Assigning students problems and fostering in them the ability to solve those problems has long been a central aspect of all school education. Understanding a problem is regarded as the process of recognizing relationships that could not previously be grasped.

For example, when trying to understand the wishes of local residents, one must seek to grasp the problem in a structured way by first listening attentively to the voices of people not always accustomed to expressing their ideas in a methodical manner. Local

people will not necessarily voice their true feelings in interviews in a one-off visit, and it may require time and the building of trust before they will talk freely. This is often the case in Asian cultures in particular. A commitment to participant observation and dialogue is, therefore, highly valued in the pedagogy of sustainability education.

The practice of learners entering a community has already been established under such terms as service-learning (Jacoby 1996) and place-based education (Sobel 2004). This practice differs from simply learning about the community. Rather than viewing the community objectively as a detached observer, the learner actually enters and lives in that community, becoming one of its members if only for a short time.

Mind (Heart)

There is no single absolute method for fostering motivation, one's own beliefs, internationalism and synchronic/diachronic consciousness. However, rather than being transmitted like conventional knowledge, these are qualities that resonate between people. This resonance requires an encounter between the humanity of the lecturer/facilitator and that of the learner, or at the very least an opportunity for the lecturer/facilitator to exhibit his or her own beliefs. An introduction in lecture format to Saussure's structural linguistics can also be useful, since the synchronic and diachronic ways of seeing that emerge have great potential to broaden the mind. There is, however, more to it than just displaying enthusiasm. A quiet walk in the forest giving learners the opportunity to make discoveries on their own could also produce a sympathetic meeting of minds between learner and facilitator.

Specialist knowledge

Conventional knowledge transmission, or the "banking concept" (Freire 1970), and exam-based formats with their attendant fear of failure are still often effective for acquiring specialist knowledge as well as the panoramic knowledge described above. However, it is good to aim for interactive lectures by creating a space for teacher-learner and learner-learner interaction, rather than providing only a one-sided flow of information. A lecture that involves students from different fields sitting together and at times exchanging opinions is an exciting prospect. Such activities foster the open-mindedness, curiosity, acceptance of the opinions of others and teaching skills that are sought in teachers of sustainability education.

Integrative abilities: considering groups and organizations

The skills described above are those an individual should possess, but of course the goal of sustainability education is not simply to turn out a succession of super-individuals. Problem-solving must be tackled in society at the organizational level. If colleagues in an organization are highly knowledgeable, a better solution is likely to emerge by pooling those resources to produce results as a group. It is also important to share with colleagues the knowledge and skills one has cultivated by oneself. Every organization is a dynamic entity (Tuckman 1965).

One method of effectively spreading knowledge among people with different responsibilities at the same level in an organization is the "jigsaw classroom" (Aronson 1978), which has become popular in school education in the West. This method can also be used for in-service training. Let us consider an example of knowledge being passed down through different age groups. At the North Vancouver Outdoor School in the Canadian province of British Columbia, high school students stay overnight with elementary school pupils for one week and act as a link between the children and instructors. A long-term cycle has already arisen in which those elementary school pupils go on to become Outdoor School counselors when they reach high school, and then as adults send their own children to the Outdoor School. In addition to normal outdoor education, pupils also learn about the wisdom of First Nation people.

Basic organization theory and learning theory can also be a part of sustainability education. For example, organization theory includes the concept of legitimate peripheral participation (LPP; Lave and Wenger 1991). In terms of this concept, the individual is aware of him/herself as a member of the organization sometimes as a novice, sometimes as an expert. In this way, the team itself grows.

In the reality of a sustainable society, those who provide knowledge and those who receive knowledge are by no means fixed players. As the learners change, so too can the providers, and through these mutual changes, the situation on the ground will change dynamically.

Tacit knowledge

As problem-solving experience is built up, a certain degree of intuition begins to develop, together with the ability to see the path to achieving a goal.

In sustainability education, training methods such as the dilemma story (Settelmaier 2009), which requires decision-making in hypothetical situations, can be used to

provide practical experience with such scenarios. By working through case studies or hypothetical situations, students acquire certain skills that come from knowledge of the relevant circumstances. To put it another way, a transformation occurs, a certain stance is formed toward problems likely to be encountered in the future, and with it the student comes to possess the ability (what one might call "second sight") to anticipate the unseen. Even if it cannot be clearly put into words, an intuition operates that steers them in the right direction, and their involvement is proleptic in nature. If students can awaken to the double-edged nature of things as having both positives and negatives, i.e., to the Chinese logic of Yin and Yang, it is possible to make judgments with foresight and understanding.

6-3-3 Examples of participatory techniques

Here we shall introduce some typical participatory techniques and describe their main features. As we have seen, there is a wide range of teaching methods in sustainability education. The traditional lecture is often effective depending on the content being presented and the motivation of the students. However, since this method will be familiar to most readers, we will discuss only participatory methods, which until now have not been widely used in higher education. The participatory format itself can be categorized in various ways: real problems or mock problems, activities in the classroom or in the real world, activities using linguistic communication or physical experience, and so forth. Games, simulations, role play and planning are used relatively often, and their characteristics are discussed below. Of course, there are many other techniques (e.g., Ishikawa 2008; Kakuta 1999), and the techniques themselves are sometimes used in conjunction with each other to make up an actual teaching activity.

Games

Games allow students to learn while having fun. There are a variety of forms, including both physical and thought-based activities. What they all share is the element of fun. Learners acquire a comprehension of complex rules and a mastery of sophisticated tactics when enthusiastically engaged in a game. Therefore, by incorporating the content of sustainability education into games, students can be made to think about combinations of complex rules or conditions while enjoying themselves. The learning content can be incorporated by modeling phenomena (simulation) or having students take roles in the game (role play). Although fun is the key characteristic, it is also

important to adequately reflect on what has been learned.

Simulation

By experiencing a mock situation through modeled phenomena, students can learn with a real sense of the processes involved in a given phenomenon. The mock experience is effective when the real phenomenon cannot easily be experienced, because, for example, it does not regularly occur, is too far away, would require many years to collect data on, or involves too many elements. In such cases, the question is how far the modeling should go. If the modeling is inadequate, it will probably be difficult to create a mock experience. If the modeling is excessive, the knowledge provided will be sufficient and will obviate the need for the mock experience. Simulation may also be incorporated into a game, and planning may also be made the subject of mock experience.

Role play

Performing a role different from their usual one allows learners to understand and think about problems from the perspective of that role. Role play could be thought of as a form of simulation in the sense that learners are having the mock experience of another person. The expression of opinions in that role is also a feature shared by debate. Debate normally involves dividing a group into proponents and opponents, but in role play a variety of positions can be set up. Role play would seem to be particularly suitable for sustainability education if it enables students to learn through the mock experience of how various interested parties think and how agreement could be reached.

Planning

Planning involves learning through the process of creating a plan for coping with a particular problem. Before a solution can be considered, the problem must first be correctly understood and analyzed. Learners must overcome challenges such as coming up with a concrete proposal, assessing its feasibility and determining whether the interested parties can agree to it. This process leads to learning, whether by dealing with a mock situation or a real one. If the latter, it may involve techniques of learning through participation in the community such as action research or service-learning.

    Whatever technique is used, the important thing is that the learners actively

participate. The participatory techniques introduced here are all group activities which require communication with other people. As pointed out in the section on games, it is important not only to engage positively in the activity itself but also to reflect on what has been learned. In other words, students should be able to participate confidently and actively, communicate appropriately, and enhance their learning through adequate reflection. It is the facilitator's job to ensure that this happens. Through sustainability education of a participatory nature, students can expect to acquire an attitude of positive participation, group communication skills, and the knowledge content of the activities, while at the same time encountering and picking up the skills of the facilitator in promoting group activity learning.

6-3-4 The continuity of sustainability education in local communities

Finally, we would like to point out the continuity that exists before, during and after university education. The discussion in this section concerns higher education as it appears at the high-level specialization stage of the T-type education model. However, before receiving a higher education, learners pass through primary and secondary education. Moreover, in today's knowledge-based society, learning is seen as necessary in all sorts of situations after the completion of undergraduate or postgraduate studies.

   A movement related to sustainability education is Education for Sustainable Development (ESD). This type of education is relatively new and hence shares similar terminology (UNESCO 2002) with sustainability education. Both types seek to educate people to build a sustainable society, and in terms of desirable abilities and teaching/learning methods, ESD shares many of the attributes discussed in this section. Higher education organizations are naturally involved, and sometimes refer to ESD as HESD.

   The decade from 2005 to 2014 has been declared the United Nations Decade of Education for Sustainable Development. The initiative is presided over by UNESCO and is being promoted in every UN member state. United Nations University also approves regional centers of expertise (RCE) which provide ESD to regional communities, and each RCE involves various local stakeholders. These include schools, universities, local governments, businesses, NPOs, NGOs, community education facilities, and so forth.

   Through this regional involvement, children, too, are beginning to learn through encounters with real problems, sometimes being taught by specialists, sometimes presenting their own opinions in the community. The usefulness of conventional

learning will also be rediscovered as not merely a way to advance to a higher-level school, but also to provide knowledge, or the necessary foundation for such knowledge, for overcoming real problems. Students wishing to be involved as specialists in creating a sustainable society can then enroll in sustainability education programs at university or graduate school.

At this stage, students engaged in sustainability education will also learn through participation in the local community, an aspect of pedagogy mentioned earlier in this section. In the role of aspiring experts, they are likely at times to be involved in the education of others within the community, and will thus feel a sense of responsibility and fulfillment as they learn.

After graduation or completion of their studies, these new experts endowed with the abilities demanded by sustainability education can expect to participate in the education of people from a range of sectors in the local community. At times, they may also be involved in the education of the next generation of undergraduate or graduate students, and they will also naturally participate in learning as members of the community.

Universities that provide sustainability education not only need to improve their existing knowledge-transmission-based teaching, but also to actively participate in this sort of community development. Outside the university, the spaces where practical learning takes place in the local community are not only spaces where undergraduates and postgraduates learn, but also where people learn before becoming students and where people simultaneously work and learn after completing their studies. Viewed in terms of the continuum of learning, the learner acquires expertise in some subject at university or graduate school as part of the entire process of learning in the community, and thereafter continues to participate in the community as a learning member.

If communities grow in this way, the simplistic model of a talented elite being educated in the leader-training institutions of higher education and going on to lead and reform society will gradually become obsolete. For example, in Japan, where 74% of high school graduates go on to higher education (53.8% to university or junior college, both statistics as of 2007), we need a model that accounts for the fact that most of the people making up a community have received some form of higher education. Since higher education is in reality positioned as the final stage of a citizen's education, there is the potential for adopting more direct and organized strategies.

Sustainability science is a new integrated domain of knowledge. In the pedagogy of sustainability education, the various theories and applications developed in its subdomains should also be integrated, and a diversity of effective teaching methods that meet various goals should be recognized.

REFERENCES

Aronson, E. 1978. *The Jigsaw Classroom*. Sage Publications.

Flavell, J.H. 1976. "Metacognitive Aspects of Problem Solving." In Resnick, L.B., ed. *The Nature of Intelligence*. Hillsdale, NJ: Lawrence Erlbaum, pp. 231-236.

Freire, P. 1970. *Pedagogy of the Oppressed*. New York: Continuum Publishing.

Ishikawa, K. 2008. "Contents, Methods and Curriculum." In Tanaka, H., ed. *Development Education: for a Sustainable World*. Tokyo: Gakubunsha, pp. 19-33. (in Japanese)

Jacoby, B. 1996. *Service-Learning in Higher Education: Concepts and Practices*. San Francisco: Jossey-Bass.

Kakuta, N. 1999. *Training Manual for Facilitators in Environmental Education: To Promote, Perform, Create and Participate*. Tokyo: International Education Resource & Innovation Center, pp. 63-66. (in Japanese)

Lave, J. and E. Wenger. 1991. *Situated Learning: Legitimate Peripheral Participation*. Cambridge, UK: Cambridge University Press.

Mezirow, J. 1991. *Transformative Dimensions of Adult Learning*. San Francisco: Jossey-Bass.

Settelmaier, E. 2009. *"Adding Zest" to Science Education: Transforming the Culture of Science Classrooms through Ethical Dilemma Story Pedagogy*. Saarbrücken, Germany: VDM Verlag.

Sobel, D. 2004. *Place-Based Education: Connecting Classrooms & Communities*. Great Barrington, MA: The Orion Society.

Tuckman, B.W. 1965. "Developmental Sequence in Small Groups." *Psychological Bulletin* 63(6), pp. 384-399.

UNESCO. 2002. *Teaching and Learning for a Sustainable Future*. Available from
    http://www.unesco.org/education/tlsf/

Related Websites

North Vancouver Outdoor School:
    http://www.nvsd44.bc.ca/programs/outdoorschool.aspx

Jigsaw Classroom: http://www.jigsaw.org/

Service Learning: http://www.servicelearning.org/

Dilemma Story: http://www.dilemmas.net.au/

UNESCO Teaching and Learning for a Sustainable Future:
    http://www.unesco.org/education/tlsf/

World Bank Participation Sourcebook: http://www.worldbank.org/

Participation Works! – New Economics Foundation (NEF):
    http://www.neweconomics.org/gen/