

Chapter 5

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Competences and competence-based learning for sustainable development

Abstract

In the context of education for sustainable development (ESD), there is extensive literature on what should be taught and learned in terms of knowledge, skills and values. What stands out in most of this literature is a prominent attention to values. The underlying idea is that value education is needed to prepare students for a role as 'agents of change', able and willing to transform our current society into a more sustainable one. What is strikingly absent from these approaches to ESD is the notion that there may be a valid diversity in perspectives on sustainable development, whereas this diversity is in fact a key feature of sustainable development in a pluralistic society. In the transition towards a sustainable (or at least more sustainable) society, the ability to deal with this diversity of perspectives will thus be crucial. We therefore argue that the key competence for academic professionals to successfully contribute to sustainable development will be their ability to think, communicate, learn and collaborate across the boundaries that divide these perspectives. We refer to the ability to cross such boundaries as 'transboundary competence'. This chapter applies the principles of competence-based learning to identify the characteristics of learning environments in which this competence can be developed.

Introduction

Higher education is currently facing two major challenges. The first challenge concerns the emergence of the knowledge society and the second challenge the widely acknowledged need to achieve sustainable development globally (UNCED, 1992; Bereiter, 2003; chapter 1). To be able to participate in today's

knowledge society and contribute to sustainable development successfully, students need to develop attitudes, knowledge and skills the traditional system of higher education often does not provide. In the knowledge society professionals should possess integrative competences rather than disciplinary separated knowledge with a limited shelf life. Learning environments in higher education are therefore increasingly geared towards competence development, with a problem-oriented approach, an authentic context and active, often collaborative knowledge construction as major ingredients. The implications for learning for sustainable development in higher education are that the focus should rather be on identifying competences and developing appropriate learning environments, than on defining the exact type of knowledge students should acquire.

Although competence is nowadays a popular concept in education and human resource management, there is still no precise, widely accepted definition. According to Stoof et al. (2002) the ongoing confusion (about the concept of competence) arises at least in part from an objectivistic quest for the one and only true definition. Instead, they propose a constructivist approach aimed at constructing a viable definition, i.e. a definition of competence that is adequate for the situation in which it is used. Common elements in definitions of competence are 'an integrative whole of knowledge, skills and attitudes', applied to 'perform complex tasks in authentic work environments', thereby meeting 'the standards or success criteria required by these environments'. In our view, this description is adequate for our purpose of identifying key competences for sustainable development.

In this chapter, we will first review various attempts and approaches to define 'competences for sustainable development'. We will then propose a set of key competences for sustainable development, based on an analysis of the concept of sustainable development and the competence requirements as identified 'in the field' in the previous chapters. Finally, the principles of competence-based learning are applied to identify the characteristics of learning environments in which these competences can be developed.

Competences for sustainable development

What to learn for sustainable development?

The term 'competences (or: competencies) for sustainable development' is not yet commonly used. However, in the context of education for sustainable development (ESD), there is extensive literature on what should be taught and learned in terms of knowledge, skills and values (see IAU, 2006). Concerning knowledge, there is a rather stable core pertaining to the concept of sustainable development and the major global sustainability problems, but apart from that a wide diversity of topics is mentioned, depending on how broadly the concept is interpreted. A similar picture is seen for skills. For example, a publication on the engineering sciences lists explicitly any skill that is associated with environment-friendly technology. What stands out in most of this literature, including publications addressing higher education, is a prominent attention to values. This is probably partly because ESD has its roots in environmental education. The underlying idea is that value-education, and – as an outcome of that – a change in attitude is needed to prepare the students for a role as 'agents of change', able and willing to transform our current society into a more sustainable one (e.g. UNESCO, 1997; Rowe, 2002). The exact nature of these values and attitudes depends on the ideological point of departure and its perspective on what a sustainable society should look like (Scott, 2002).

This prevailing approach has been criticised by some as being 'instrumentalist', i.e. using education as a 'conditioning tool' to serve the goals of government policy or the agenda of any other organisation powerful enough to influence the curriculum (e.g. Jickling, 1992). The opponents advocate an 'emancipatory' approach, aimed at teaching the students to critically weigh the various claims pertaining to sustainable development. Although a critical attitude is certainly a desired outcome of higher education, it remains yet unclear how this may positively contribute to sustainable development. Neither is it clear what the 'gold standard' should be to which different claims can be compared. Yet another group of authors (e.g. Orr, 2002) advocates critical thinking on the assumption that this will inevitably result in 'ecologically correct' convictions.

In Germany, the debate about ESD has resulted in the concept of 'Gestaltungscompetenz' as the central learning objective (Seitz and Schreiber,

2005; De Haan, 2006; chapter 9). *Gestaltungscompetenz* literally means the competence to design and shape, and is described as 'a forward-looking ability to modify and shape the future of our society in terms of sustainable development, through active participation' (De Haan and Harenberg, 1999; De Haan, 2006). The concept can be viewed as a combination of the emancipatory and the instrumentalist approach to ESD, as it emphasises both individual autonomy and active participation in societal transformation.

Diversity of perspectives

What is strikingly absent from these current approaches to ESD, is the notion that there may be a valid diversity in perspectives on sustainable development. This is remarkable as one of the most prominent features of the concept of sustainable development is the many different ways in which it is interpreted. This diversity seems inevitable, given the global scale and complexity of sustainability problems and the many uncertainties that surround them. In a pluralistic approach, one accepts this diversity as valid, i.e. stemming from different, but equivalent value systems that result in different, but internally consistent perspectives on sustainable development. Even if one would reject the equivalence of different value systems and advocate a superior perspective, one should realise that in an open democracy plurality is a fact of life. It is unlikely that through (higher) education the majority of the population, nationally or even globally, could be converted to a single 'superior' perspective. The diversity of perspectives among teachers alone would already be prohibitive (cf. Shephard, 2005). Therefore, instead of ignoring this diversity, we explicitly take it as our point of departure when defining key competences for sustainable development.

The major cause of the many different perspectives on sustainable development is the ambition underlying the concept to link the ecological, economical and socio-cultural aspects of development, and to connect development here and now with development elsewhere and in the future. This multi-dimensional approach to development is so comprehensive that it is almost impossible to catch it in a single, balanced perspective. Furthermore, due to the complex nature of sustainability problems, the large spatial scales on which they occur and their long-term effects, there is considerable uncertainty and (consequently) dissensus in the scientific knowledge about

these problems. This leaves room for multiple interpretations of the risks involved and how they should best be managed. Finally, sustainable development is in essence a normative concept, and although there is a broad agreement on its core values, inter- and intra-generational justice, the interpretation and the relative weight that should be given to the various interests when weighing the pros and cons will differ according to one's philosophy, social position, discipline, etc.

The diversity of perspectives can be valued positively for several reasons. The thrust of sustainable development is to prevent as much as possible shifting of the burden of improvements in one domain or for one group to other domains or groups. Taking a diversity of perspectives into account will thus provide a sharper eye to detect such shifts, and may result in more balanced decisions. Multiple perspectives could also enable a richer definition of complex sustainability problems and produce a wider array of potential solutions, which, in the face of uncertainty, enhances the probability to find adequate solutions (Janssen and Osnas, 2005). However, the diversity of perspectives also entails a risk of conflict, political paralysis and a lack of societal support at a time when joint, large-scale measures may be urgently needed (Keulartz, 2005). Such situations are likely to occur, because, despite intentions to prevent unjust shifts of costs, some groups are bound to win (or lose) more than others.

Diversity in perspectives thus creates the need for negotiation and dialogue or social learning (Leeuwis, 2002), to arrive at richer, more complete definitions of sustainability problems, a wider array of potential solutions, and more balanced, broadly supported measures.

The concept of transboundary competence

In the context of higher education, we define competences for sustainable development as those combinations of knowledge, skills and attitudes that enable graduates to effectively contribute to transition processes towards a (more) sustainable society, on the basis of their domain-specific expertise and more general academic competences. As outlined above, the ability to deal with a diversity of perspectives is crucial in such transition processes. We therefore argue that the key competence for academic professionals to successfully contribute to sustainable development will be their ability to

think, communicate, learn and collaborate across the boundaries that divide these perspectives. We refer to the ability to cross such boundaries as ‘trans-boundary competence’. This ability is essential as it will be impossible for students to develop a ‘super-perspective’ and become a ‘sustainable development specialist’ with a comprehensive combination of knowledge, skills and values. Rather they will, as graduates, contribute to sustainable development, often in team work, on the basis of their own values, individual talents and specialised expertise. To do that effectively however, they should be aware of their own limitations, acknowledge the diversity of perspectives, and be able to think across boundaries and build bridges between their own perspective and that of others (Keulartz et al., 2004). Major boundaries to be crossed when contributing to sustainable development are those between:

- parts or subsystems;
- disciplines;
- science and other societal domains;
- nations or cultures;
- local and global scales;
- short and long-term (time scales);
- conventional and innovative approaches.

Transboundary competence thus comprises the abilities to take a whole systems-oriented, interdisciplinary, participatory or transdisciplinary, international, cross-cultural, cross-scale, future-oriented, and creative approach to sustainability problems. Of course, the degree in which all these abilities will be developed may vary among students and study programmes.

The array of abilities presented above, corresponds with the competence requirements as identified in the areas of scientific research, policy development and technological innovation for sustainable development. The previous chapters emphasised the need for an international, global perspective (chapter 1), a systems approach and interdisciplinarity or transdisciplinarity in scientific knowledge production on sustainability problems (chapter 2), as well as the need for participatory approaches and creative solutions in steering of sustainable development (chapter 3), and the need for cross-boundary learning to turn technological discoveries into sustainable innovations (chapter 4). Subsets of the identified transboundary abilities have been frequently proposed by various other authors and groups (e.g. Crofton,

2000; CSR Europe, 2005; Barth and Busch, 2006; De Haan, 2006; DHO, 2006).

To be perfectly clear, the concept of transboundary competence fully acknowledges that sustainable development is a value-laden, normative issue, but at the same time accepts that there are no objective standards to select the one and only true perspective on sustainable development. We therefore advocate a pluralistic approach to ESD in higher education. From this pluralistic viewpoint, the ability to empathise and communicate with other perspectives is essential.

Competence-based learning environments for sustainable development

Perhaps as a consequence of the focus of the ESD debate on *what* to teach from *which* particular perspective, there has been little attention for the development of a didactic framework and the design of appropriate learning environments for higher education, as compared to ‘greening the campus’ activities (HEFCE, 2005). In this section we will first discuss the concept of competence-based learning and then apply this concept to identify the characteristics of learning environments in which competences for sustainable development can be developed.

Competence-based learning

The concept of competence-based learning has been developed over the past decade and has gained ground as a dominant educational approach in The Netherlands. Its development was a response to the requests of the labour market and the wish of educators to make formal education more meaningful and relevant. The idea is that learning should focus on integrative competences required in professional life, and not on the acquisition of isolated skills and pieces of knowledge. Life-long learning skills are seen as an essential part of competences, as both the ‘state-of-the-art’ and professional requirements are rapidly changing. Constructivism is usually the dominant paradigm in competence-based learning, and learning environments that stimulate active, contextual construction of knowledge and understanding and active acquisition of competences are favoured

(Könings et al., 2005). The best way to acquire these competences appears to be in a learning environment that combines actual practice ('learning by doing'), and explicit reflection on what and how to learn from that practice ('learning by reflection'). 'Learning-by-doing' involves that the learning environment is realistic or authentic in terms of the problems the students have to solve, the tasks they have to perform, and the context of these tasks. 'Learning-by-reflection' involves that students explicitly reflect on their learning goals, activities, results and ways to improve.

In our view, the concept of competence-based learning offers an excellent didactic framework for learning for sustainable development, in which the acquisition of transboundary competence is seen as central. The constructivist paradigm, which considers knowledge as a (social) construct of reality and not as the absolute objective truth about reality, corresponds with our pluralistic approach to the multiple perspectives in society on sustainable development, whereas the constructivist approach to learning as the (joint) production of context-embedded knowledge matches the need to find context-specific sustainable solutions shared and supported by many.

Learning environments for sustainable development

In the philosophy of competence-based learning, a learning environment for sustainable development should thus ideally foster transboundary competences through 'learning-by-doing' combined with 'learning-by-reflection' (table 1). In an ideal learning environment, the problems or case studies should be ill-structured and concern sustainability issues, covering multiple domains and spanning multiple scales of space and time. The tasks to be performed would be open-ended and require active integration of different parts of the problem and knowledge from different domains, and thinking and reasoning across different scales of space and time. Creative solutions to the problem could be stimulated by introducing, for example, brain storm sessions. The tasks would preferably include the need to consider other perspectives on the problem, from different disciplines or different cultural viewpoints. A realistic context could be created by introducing teamwork in heterogeneous groups in the learning environment and/or by creating an open learning environment. This would necessitate the students to communicate or even collaborate with real persons with a different disciplinary, national or cultural background or societal position.

Table 1: Characteristics of a competence-based learning environment applied to learning for sustainable development (LfSD). See text for detailed explanation.

General feature	Application to LfSD
realistic problems or cases	<ul style="list-style-type: none"> • ill-structured problem description • multiple scale, multiple domain issues
realistic tasks or roles	<ul style="list-style-type: none"> • open-ended • active integration of different aspects of problem and knowledge from different domains • thinking and reasoning across diverging scales of time and/or space • stimulating creative solutions • dealing with multiple perspectives on the problem
realistic context	<ul style="list-style-type: none"> • heterogeneous student groups (multidisciplinary, multi-cultural, international) • open learning environment, interaction with experts, clients or stakeholders from outside university
explicit reflection on task performance and learning	<ul style="list-style-type: none"> • reflection on quality of products in relation to quality of processes and learning strategies • reflection on processes in heterogeneous groups (negotiation, social learning) • individual reflection complemented by group discussions and organised feedback (preferably also from outside the university)

Essential for effective competence-based learning is explicit reflection on the activities, how they contribute to the development of transboundary competence, how this relates to personal goals, and how performance and learning could be improved. This would involve writing and discussion of reflection reports. In this way, the students also learn better to reflect, which is an essential skill for crossing the boundaries of one’s own perspective

and a prerequisite for social learning. Social learning processes play an important role in multi-disciplinary teamwork, organisational innovations and novel policy arrangements for sustainable development (see chapters 2, 3, and 4). For the development of transboundary abilities it is important not only to reflect on the quality of content-related products (such as problem definitions, analyses, solutions), but also on the processes or strategies by which these products came about. In particular, processes like negotiation and learning in heterogeneous groups, should be a topic of explicit reflection. Individual reflection on personal motivations, goals, strategies and contributions, must be complemented by the perspectives of others through group discussions of these topics and organised feedback, preferably also from outside the university.

In traditional learning environments, group work on projects in realistic, cross-boundary contexts is difficult to realise. It requires bringing students from different disciplinary, national and cultural backgrounds repeatedly together at the same time, at the same place. E-learning, or more precise computer-supported collaborative (CSCL) learning environments provide an innovative and almost ideal solution to this problem, as the modern ICT-tools they exploit allow time and place independent communication and group work (Ivens et al., 2002). Another advantage of an electronic learning environment is that most communication will be in writing, enabling deeper and more structured discussions. Open universities have played a pioneering role in the use of electronic learning environments, out of necessity. However, given the advantages for multi-disciplinary and internationally-oriented education, interest and actual implementation at regular universities is rapidly growing.

In the next four chapters, concrete examples of innovative learning environments are presented. The chapters discuss the characteristics of the learning environments and how these relate to the development of transboundary competence.

References

- Barth, M., and Busch, A. (2006), *Competencies & Higher Education for Sustainable Development*. Working paper. Institute for Environmental and Sustainability Communication, University of Lüneburg, Lüneburg.
- Bereiter, C. (2003), *21st Century skills – challenge or fallacy?* In: E. de Corte et al. (Eds.), *Powerful learning environments: unravelling basic components and dimensions*. Elsevier Science, Oxford.
- Crofton, F.S. (2000), *Educating for sustainability: opportunities in undergraduate engineering*. *Journal of Cleaner Production* 8: 397–405.
- CSR Europe (2004), *Equipping Europe for CSR and sustainable development: optimising skills & competence*. Report of a conference held at Suez Tractebel, Brussels, 11 December 2003.
- de Haan, G., and Harenberg, D. (1999), *Bildung für eine nachhaltige Entwicklung*. Gutachten zum Programm. Issue 72, Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung, Bonn.
- de Haan, G. (2006), *The BLK '21' programme in Germany: A 'Gestaltungskompetenz'-based model for Education for Sustainable Development*. *Environmental Education Research*, 12: 19–32.
- DHO – Stichting Duurzaam Hoger Onderwijs (2006), *Kerncompetenties*. DHO Jaarboekje 2006.
- HEFCE – Higher Education Funding Council for England (2005), *Sustainability Consultation*. Available at: http://www.hefce.ac.uk/pubs/hefce/2005/05_01/05_01.doc
- IAU – International Association of Universities (2006), *Selected bibliography on education and sustainable development*. Available at: http://www.unesco.org/iau/sd/sd_bibliography.html
- Ivens, W.P.M.F.; van Dam-Mieras, M.C.E.; Kreijns; C.J, Cörvers, R.J.M.; Leinders J.J.M., (2002), *Use of virtual communities for education in sustainable development*, in: *Proceedings Conference Engineering Education in Sustainable Development*, Delft, 24–25 October 2002, p. 602–610.
- Janssen, M.A. and E.E. Osnas (2005), *Adaptive capacity of Social-Ecological Systems: Lessons from immune systems*. *EcoHealth* 2: 1–10.
- Keulartz, F.W.J. (2005), *Boundary-Work – The tension between diversity and sustainability* Paper presented at the conference on

- Sustainability at Universities in the Czech Republic: What are Possibilities, September 2005.
- Keulartz, J., M. Korthals, M. Schermer, and T. Swierstra (2004), Pragmatism in progress: A reply to Radder, Colapietro and Pitt. *Techné* 7(3) Spring 2004: 38–48.
- Könings, K.D., Brand-Gruwel, S., van Merriënboer, J.J.G. (2005), Towards more powerful learning environments through combining the perspectives of designers, teachers and students. *British Journal of Educational Psychology* 75: 645–660.
- Leeuwis, C. (2002), Making explicit the social dimensions of cognition. In: Leeuwis, C. and R. Pyburn (Eds), *Wheelbarrows full of frogs. Social learning in rural resource management*. Royal Van Gorcum, Assen, pp. 391–406.
- Orr, D. (2002), Foreword. In: S. Sterling, *Sustainable education: Revisioning learning and change*. Schumacher Briefings No. 6, Green Books.
- Rowe, D. (2002), Environmental literacy and sustainability as core requirements: success stories and models. In: Walter Leal Filho (Ed.), *Teaching sustainability at universities*. Peter Lang, New York.
- Scott, W. (2002), Sustainability and learning: what role for the curriculum? Inaugural lecture, 25 April 2002, University of Bath.
- Seitz, K. and J.R. Schreiber (2005), Towards sustainable development – Learning for a world qualified for the future. A discussion paper of the Association of German development non-governmental organisations (VENRO) on the UN Decade of Education for Sustainable Development 2005–2014. VENRO-working paper no. 15.
- Stoof, A., Martens, R. L., Van Merriënboer, J. J. G., and Bastiaens, T. J. (2002), The boundary approach of competence: a constructivist aid for understanding and using the concept of competence. *Human Resource Development Review*, 1: 345–365.
- UNCED (1992), *Promoting education, public awareness and training, Agenda 21, Chapter 36*, UNCED, UNESCO, Paris.
- UNESCO (1997), *Educating for a sustainable future – a transdisciplinary vision for a concerted action*. UNESCO, Paris.