Learning in Networks for Sustainable Development

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Abstract

The didactic model of remote internships described in this study provides the flexibility needed to support networked learners, i.e. to facilitate the development and subsequent assessment of their competences. The heterogeneity of the participants (students, employers, tutors) in the learning network provides relevant diversity in expert perspectives.

In today's (networked) business environment, ever more collaboration takes place through virtual platforms and tools. Learning for Sustainable Development could profit from the opportunities such platforms offer, as part of it. Taken from the Brundtland Report (1987), Sustainable Development is development that "meets the needs of the present without compromising the ability of future generations to meet their own needs". Sustainable Development has a high level of complexity, with its need for integration of socio-political, environmental and economic perspectives, its uncertainty in future and its dedication to an enormous range of levels of scale, acting from local to global. Because of the complexity of the concept, the defining of competences and learning outcomes for Sustainable Development is not easy. Learning for Sustainable Development could be described as obtaining the ability to cross the boundaries between multiple perspectives in interaction with stakeholders and actors in sustainability issues. An authentic example on the Dutch-Flemish Scheldt Estuary debate, described in the present study, shows such different perspectives and how they influence the scientific study of and decision-making on sustainability issues. We argue how learners who have to deal with these kinds of different perspectives will develop their personal competences in an effective way. The didactic model of remote internships that we use, allows learners to work in virtual teams on current, authentic research assignments in contact with their customers: real employers in the professional field. Moreover, the didactic model enables learners to define their own activities according to their personal learning goals matching the external requirements of employer and university. This allows our learners - adult distance students at the formal BSc Environmental Sciences programme (Open Universiteit) - to start from their own unique perspectives, having different prior knowledge, in different learning domains and from different professional experiences. The multiple perspectives show themselves in the practice of virtual cooperation with peers and experts from both the academic and professional community. Thus, the present study explores how an online remote internship model can effectively support competence development in a heterogeneous professional learning network.

1   Introduction

Proceedings of the 7th International Conference on Networked Learning 2010 , Edited by: Dirckinck-Holmfeld L, Hodgson V, Jones C, McConnell D & Ryberg T

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ISBN 978-1-86220-225-2

The question of how to become competent for Sustainable development has triggered educators and designers of curricula ever since the concept of Sustainable Development was endorsed at the highest political levels in the late 80s. The most-often quoted definition of sustainable development, taken from the Brundtland report (1987), is development that "meets the needs of the present without compromising the ability of future generations to meet their own needs." At the Johannesburg World Summit in 2002, society's social structure was incorporated in the concept, which puts it at the heart of the integration of socio-political, environmental and economic sustainability: People Planet Profit, which must be established at local, regional, national and global levels. Moreover, since people have become aware of global environmental problems, such as climate change, global warming and loss of biodiversity, the nature, extent and solution of those problems have become uncertain. These uncertainties exist not only because of the extent of these global issues and the inherent uncertainty of the future, but also because of the profound disagreement among scientists about their magnitude, nature, and underlying phenomena.

The concept of Sustainable Development has a high level of complexity, with its need for integration of mutually counteracting and/or reinforcing perspectives (socio-political, environmental and economic), its uncertainty (unknown future outlook, unknown nature of problems and phenomena) and its dedication to an enormous range of levels of scale (scales of time and scales of space: acting from local to global). Because of the complexity and diversity of the concept, the defining of competences and learning outcomes for Sustainable Development is not easy (Van Dam-Mieras, Lansu, Rieckmann & Michelsen (2007), which makes it even more difficult to design adequate learning modes through the academic curricula (Kastenhofer, Lansu, van Dam-Mieras & Sotoudeh, 2010). From our point of view, we consider Learning for Sustainable Development very much directed at the competence *to view issues of sustainable development from multiple perspectives* (De Kraker, Lansu & van Dam-Mieras, 2007). This makes Learning for Sustainable Development clearly distinct from the main stream, value-oriented Education for Sustainable Development (ESD). This much became evident when De Kraker et al. (2007) reviewed our activities for the United Nations Decade of Education for Sustainable Development (DESD 2005-2014) (UN, 2002; UNESCO, 2007), the worldwide programme directed to integrate Education for Sustainable Development at all levels of formal and non-formal education and learning. In order to reach the Millennium Development Goals how to become competent for Sustainable Development is one of the major research questions to be solved.

This paper discusses how learners could gain the competences for Sustainable Development needed within formal academic curricula

A recent example on the Dutch-Flemish Scheldt estuary debate illustrates the requirements needed to define these professional competences needed in Leaning for Sustainable Development. It made evident that in order to be able to handle sustainability issues, the different perspectives and expertise of all stakeholders and uncertainties about future developments must be taken into account, in interaction with these stakeholders.

We argue that learning modes in which learners, employers and tutors are in contact with each other and with their (professional) communities could provide the multiple perspectives on the issues. What are the characteristics of such a networked learning environment in which such competences can be developed? Which conditions have to be met in formal curricula? Starting from these conditions, we show the characteristics of a remote internship model from the Open Universiteit, functioning as a networked learning environment.

Finally, we argue that in Learning for Sustainable Development lifelong learning seems to be a prerequisite, because ongoing change and multiple perspectives also in time and space are characteristic for the domain.

2   Learning for Sustainable Development

2.1   Learning from Multiple Perspectives: Transboundary Competence

If we want to study how learners in academic curricula could become competent for Sustainable Development, we should start to define these competences. However, the term 'competences for sustainable development' is not yet commonly used. According to De Kraker, Lansu & van Dam-Mieras (2007) much is published in the context of education for sustainable development (ESD) on what should be taught and learned in terms of knowledge, skills and values (Corcoran & Wals, 2004); International Association of Universities (2006). Apart from a wide diversity of knowledge topics and a large list of skills, what stands out is a prominent attention to values, to prepare students for a role as 'agents of change'. De Kraker et al. (2007) point out that the notion that there may be a valid diversity in perspectives on sustainable development in society, is strikingly absent. But the need for such diversity is inevitable, given the complexity of sustainability problems and the uncertainties that surround their understanding and resolution. The key competences, then, for academic professionals to successfully contribute to sustainable development will be their ability to think, communicate, learn and

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collaborate across the boundaries that divide these perspectives. De Kraker et al. (2007) refer to the ability to cross such 'boundaries' as the '*transboundary competence*'. Professionals working on sustainable development issues should be aware of their own limitations, acknowledge the diversity of perspectives and be able to think across boundaries and build bridges between these perspectives. With this in mind, we try to extract these limitations and boundaries, the components of 'transboundary competence' between the multiple perspectives to sustainable development using a current, authentic example

2.2   An Authentic Example of Multiple Perspectives: the Dutch-Flemish dispute on the Scheldt Estuary

In August, September and October 2009, a relatively simple environmental problem on the pros and cons of an artificial levee breach for nature development (in Dutch 'ontpoldering') got full media coverage in both the Netherlands and the Flemish part of Belgium. It escalated in an international dispute in which the Flemish prime minister summoned the Dutch ambassador on August 13th 2009. This debate is a wonderful example of the multiple perspectives on environmental problems in today's pluralistic society. It influences the scientific analysis and solution of the problem. Furthermore, it shows the need for transboundary competences in Learning for Sustainable Development.

From a mere scientific point of view, the environmental problem seems to be quite simple. The Western Scheldt ('Westerschelde') is a Dutch estuary at the mouth of the 350 km long French-Belgian Scheldt River and includes the main shipping route to the port of Antwerp, the second largest harbour in Europe. The riverbanks of the floodplain consist of tidal flats and brackish and salt marshes. Because of the floods at high tide (twice a day), these are harsh environments and ecologically the most productive areas of the world; they support large numbers of shorebirds and seabirds, many of which are endangered species. Flanders and the Netherlands both recommitted themselves in the 2005 Treaty to improve the main shipping route. Deepening the river by dredging would give access to world's largest mega container ships. However, deepening the river implies both a broadening of the river floodplain by reaching a natural equilibrium state (imagine a V-shaped river channel) and a pattern shift in the tidal flows twice a day. This deepening and accompanying broadening of the river implies destruction of tidal flats and marshes by abrasion and loss of natural environments and biodiversity. Scientifically, the solution to this loss is quite simple: allocate new areas of land to compensate for this loss of estuarine ecosystems in the Scheldt. These new wetland nature reserves could be located on the landside of the river levees by raising the groundwater level or on the riverside by managed realignment of the old river levees. The 2005 Treaty is clear: the Flemish and the Dutch agreed on a particular quantity of hectares of arable land to be reintroduced to the river floodplain.

This example quite well illustrates that in seeking solutions for an environmental problem, one has to take into account the multiple perspectives of all the stakeholders involved.
Just when river dredging was to start, a legal dispute revealed other, non-scientific perspectives on this environmental problem. The Dutch Council of State, the highest administrative court in the Netherlands, ordered to halt the dredging until more was known about the guarantee of nature compensation. The Dutch government had just refused the artificial levee breach to flood the 300 hectare large agricultural Hertogin Hedwigepolder and was still studying alternatives. This refusal was probably an effort to acknowledge the arguments of rural and agricultural voters, who were furious about the loss of man-made polders, dikes and high-quality arable lands. Dutch regional citizens and politicians protested against the destruction of levees, probably because of the emotional remembrance of the catastrophic North Sea Flood of 1953 in which some 2400 people lost their lives and considerable damage on properties was incurred. Based on research (described and summarized in Nijpels, Heip, Hulscher, Heijkoop & Verbree, 2008) nature organisations showed that innerdyke wetlands (landside; fresh water) could not compensate for the loss of the ecologically high-valued nature of the outerdyke tidal flats (river side; brackish). According to Kistenkas (2009), the scientific report of Nijpels et al. (2008) functioned as leverage in a faltering process of decision-making.
The Flemish politicians interpreted the stop of the dredging as a geopolitical act in favour of their rival, the Dutch port of Rotterdam, which is the largest port in Europe. Antwerp citizens, frightened for the loss of jobs in their harbour, started to boycott the degustation of Dutch mussels, as 'moules frites' an iconic Belgian dish. The row on the 2005 Treaty goes back to sentiments from a distant past: by international treaties set in 1830 the Netherlands guarantee free access to the Belgian harbour of Antwerp, after the – then- Dutch Western Scheldt had been closed for shipping for centuries (see background articles in international news papers: Smyth, 2009; van Middelaar, 2009). It escalated in an international dispute in which on August 13th 2009 the Flemish prime minister summoned the Dutch ambassador. This binational dispute ended with the decision of the Dutch Cabinet

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on October 9th 2009 to respect the 2005 Treaty and to allocate the Hertogin Hedwigepolder as a nature compensation area.

Table 1, adapted from De Kraker et al. (2007), shows the major boundaries to be crossed when contributing to the understanding and solution of sustainable development issues, along with the approach needed to overcome them. In the table, 'transdisciplinary' refers to working with knowledge from outside the academic arena, 'participatory' to working in interaction with societal actors or groups. (Van Dam-Mieras et al., 2007).

Table 1: The boundaries between the multiple perspectives to sustainable development issues in general, in the example Scheldt Estuary and the related approaches to cross these boundaries when contributing.

Boundaries between	In example Scheldt Estuary	Approach to cross
Systems and subsystems	Estuarine systems (tidal system; endangered habitats)	Systems-oriented
Disciplines	Marine biology, earth system science, legal and political science; governance	Interdisciplinary
Science and society	Common knowledge; Value of nature; Scientific best solution – Societal best solution	Transdisciplinary and participatory
Nations	Belgium; Netherlands	International or transnational cooperation
Cultures	Flemish-Dutch, regional sentiments (Flood Disaster, loss of jobs in harbour or in aquaculture)	Cross-cultural
Scales of space: Local to global	River bank, Polder, Region, Nation, European	Cross-scale
Scales of time: short- and long-term perspectives	Harbour access, Habitat and Sustainable development goals	Future-oriented; back-casting
Technique or methods: conventional and innovative	Innerdyke or outerdyke compensation; man-made levees and reclamation of land or innovative water management	Creative thinking; designing

Note: adapted from de Kraker et al. (2007)

In addition, the debate in the newspapers shows all aspects of transboundary competences for sustainable development. Both the papers' headlines on October 10th 2009 (table 2) and the evaluation research underlying the decision (Nijpels et al, 2008) show the borders between discipline, societal groups, nation, and culture. The example also shows another aspect of Learning for Sustainable Development: the need to work in a transdisciplinary and participative fashion, in interaction with all actor groups or stakeholders involved.

Table 2: Multiple, opposite perspectives on the Dutch-Flemish Scheldt estuary debate in the news media headlines on October 10th 2009, after the Cabinet Decision.

	National, Belgian-Flemish	
	(1) Daily newspaper De Standaard *Polder remains dry until 2012.*	
Regional, Rural/Agricultural		**Regional, Nature**
(4) Daily newspaper Agrarisch Dagblad, *Dredging starts in February.*		(2) Provincial magazine zeeuwselandschap.nl *Cabinet Decision Western Scheldt good for nature, ...*
(5) Daily newspaper PZC *Downright disappointment, it (the protests to keep the polder dry) did not work out.*		
	National, Dutch	
	(3) Daily newspaper NRC *Hedwigepolder under water anyway.*	

Note: Newspaper headlines (2009, October 10).

A remarkable difference, which clearly shows the diversity in cultural, national and scientific views in the dispute, is the Babylonian confusion in the search for outerdyke or innerdyke nature areas. Although monolingual – both Flemish and Dutch people use the Dutch language – they do use these terms in an opposite meaning (Schelde InformatieCentrum, 2009). Whereas the Flemish innerdyke areas are situated along the riverside of the river dikes, the Dutch innerdyke areas are situated just opposite, along the landside of the river dykes (Figure 3). This really confuses the binational debate on the allocation of new nature reserves. The perspectives are not only metaphorically but also literally opposites. To understand the difference, one must

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show transboundary competences and the ability to change perspectives: just comparing the Flemish fluvial point of view (from headwaters to mouth) with the Dutch coastal defence 'dry feet' point of view (from land to river**.**

3 Learning in networks in formal education

3.1 Learning Environments for Learning for Sustainable Development

Such an authentic situation as the Dutch-Flemish Scheldt Estuary is an ideal learning environment to develop transboundary competences, as one is confronted with the various perspectives in which stakeholders handle the sustainable development issues. The characteristics of learning environments in which transboundary competences can be developed must meet the approaches mentioned in Table 1, from system-oriented to creative thinking. Using such approaches, future professionals learn to recognize, cope with and cross these boundaries. Because each learner will start from its own unique perspective - having different prior knowledge, in different learning domains and from different professional experiences - the actual learning trajectories will vary among students. Below we list the main characteristics of learning environments that are suitable for the development of transboundary competences.

- Multiple perspectives: The approaches mentioned in Table 1.
- Reflection: Learn to be aware of and recognise one's own perspective and that of others in authentic situations.
- Interaction (heterogeneous teams): Confrontation with and learning from other perspectives asks for interaction with others; A heterogeneous group of learners will encourage each learner to approach a question from his or her own perspective and area of strength; this will add to the knowledge of the whole group.
- Life long learning: Boundaries between domains and perspectives will continuously change over time.

Relevant characteristics of communities of life long learners are:
- Heterogeneity as to age, gender, study time available (dayshifts), professional background (profession; industry); professional development (prior profession); other communities.
- Flexibility as to time, content, entry requirements, instructional approach and resources, delivery and logistics (Collis & Moonen, 2001; revised from Collis, Vingerhoets & Moonen, 1997).

Lifelong learning is especially relevant in the context of learning for sustainable development. The high complexity of the professional field and the quick turnover of knowledge and insights make learning on a continual basis necessary. In a networked learning environment, it is important to have a heterogeneous group of students working together (Lindfors, 2006). Working in heterogeneous teams better removes participant biases than does working in homogeneous groups (Convertino, Billman, Pirolli, Massar & Shrager, 2008), although attention has to be given to the phenomenon that socially connected members in heterogeneous teams tend to focus on maintaining their social connections by contributing the knowledge possessed in common rather than on sharing the knowledge they uniquely possess (Thomas-Hunt, 2003). Explicitly using the unique expertise of learners (prior knowledge gained from prior study and prior and actual professional practice) could overcome this focus on social connections.

Effective collaboration models in virtual teams working in multinational companies differ from onsite collaboration experiences (Dekker, Rutte, & Van den Berg, 2008). Dekker et al. (2008) stated from prior research that some behaviours that are found in virtual teams have not yet been covered in frameworks of face-to-face interactions. Study of critical interaction behaviours among collaborating people in global virtual teams, reveals that extra attention is needed for cultural differences. In the findings of Dekker et al. (2008), this is also true between Belgian-Flemish and Dutch national cultures. The same critical interaction in Flemish-Dutch collaboration we have shown in the Scheldt Estuary example given above, although the stakeholders involved speak the same, Dutch language.

4 Remote internships: an effective Learning Network?

4.1 Remote internships: competence-base learning and working

Following De Kraker et al. (2007), competence-based learning and context-embedded production of knowledge represent an ideal match for sustainable development education. In recent years, the School of Science at the Open Universiteit (OUNL) transformed its academic distance-education programmes in Environmental

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Sciences. It did so in order to give competence-based programmes in e-learning much more emphasis and to meet both the needs from society for transboundary competences and up to date academic standards. At the end of the Bachelor programme, students of the OUNL carry out their Bachelor thesis work in a collaborative and interdisciplinary research project in a remote internship format (Lansu et al., 2009, Ivens at al., 2007). The remote internships last a full academic term, during which learning and working experience are fully integrated in the distance-learning environment. Students work in teams on authentic research questions on behalf of companies or organisations in the Netherlands and Belgium. Within the academic standards of the university and conform the specifications of the employer/client, the student teams give expert advice on environmental and sustainability issues. These advices are delivered as authentic products such as consultancy advice reports based on scientific research. Students work and learn in mutual interaction with their fellow-students (within their teams), with their mentor at the company or organisation, and with their tutors at the university. The focus on individual competence development according to the personal development plans of the students is unique, as is the 10 years – sustainable – experience we have gained with this form of training. This remote internship format is designed as a virtual company (described in Westera & Sloep, 1998) integrating learning and working in networked learning cycles of personal and professional development. After a pilot track among students in 1998, the remote internship format is slightly adapted on regularly basis, but still running in its key educational design (Ivens et al., 2007). Student data on the years 2000-2009 of this collaboration model are at hand.

4.2 A reconnaissance study: first results

How to develop transboundary competences in networked learning on authentic sustainable development issues is the central research question in assessing the data collected from the remote research internships at OUNL.

From 2000 on, the learning environment was supported by web-based collaborative groupware (EMC Documentum eRoom (2009) which made is possible to (re)design the learning environment via a rapid prototyping process and to archive the experiences of the students and tutors using the learning environment as their online workplace. Each semester, a couple of virtual teams starts working on authentic problems provided by external companies or organisations and delivers their thesis reports (at Bachelor of Science level) as research-based advices. The use of EMC Documentum eRoom made it relatively easy to archive learner characteristics and learner evidence on personal and professional development, from the student's application and project definition to evaluation, certification and BSc graduation.

Working, learning and meanwhile educationally (re)designing the didactic model take place in the same learning environment. During the years 2000-2009, 135 students applied for a remote internship, which they concluded with a BSc thesis. The number of certified students compared to the total number of applicants over the period 2000-2009 is very high: 89, 6%, also the grades were high. This suggests a high effectiveness of learning and a high motivation of students. All (100%) of the certified students end up with a formal diploma in the BSc programme (propedeuse, short cycle, BSc).

Generally, virtual teams of 2 to 4 students, worked collaboratively on the online remote internship projects. These were heterogeneous teams, according to the heterogeneity of the students certified over the period 2000-2009 (18,5% Flemish, 81,5% Dutch; , 37,0% female and 63,0% male) or more in detail (6,7% Flemish female, 11,8% Flemish male, 30,4% Dutch female; 51,1% Dutch male). There is no difference between the 8,1 % students, which had to finalize two different remote internships in two separate semesters (completing the whole BSc study; no prior conventional bachelor education) and the group of students (91,8%) who had to follow only a single remote internship, because of prior diplomas (mostly professional bachelor diplomas in biomedical analysis, environmental management, chemistry or other related domains).

As we discussed earlier in this paper the heterogeneity of the group of remote internships by virtual teams is an important factor enriching the learning process. Looking at the characteristics of the students involved, different dimensions of heterogeneity can be found. To illustrate this point we use the data on the semester track 2008-II (august 2008-april 2009) containing 14 students. This is a representative subset of the population over the period 2000-2009. 12 students of this group received the certificate. At the start of the track they differed in the availability of the time for the study, ranging from 15-10 dayshifts(4) to 9-5 dayshifts (7) to less than 5 (3). [Two Dutch male applicants left the internship prematurely for personal reasons). One Flemish female left the team in the final month due to collaboration constraints, but finished a separate work package of the project].

The first dimension of heterogeneity is age. Mean age at enrolment of the applicants is 36, ranging from 23 to 45. Looking at gender, 6 out of the 14 students were female. The group consisted of 9 Dutch students and 5 Flemish students.

Heterogeneity in terms of professional and educational experience can be demonstrated when we look at the industry sector in which students work and their actual jobs. Only 2 students worked in a sector directly related

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to the environmental sector (directorate general of water management and environment consultancy), the others were employed in such diverse sectors as education (2), municipalities (2), pharmaceutics industry (2), academic medical centre (2), farm (1), automobile industry (1). Their jobs ranged from youth coach, data manager to advisor on water management plants. It is interesting to notice that during the study, 11 of the 14 students changed jobs; 5 of them went to a job that was directly related to the environmental sector (e.g. nature management, biology teacher, environmental safety coordinator).

Finally, belonging to various networks is an important factor in heterogeneity. Obviously almost all students indicated that they belong to their family networks, having families with children, but they also indicated their relation to other communities on themes as youth working, rural spatial planning but also musical productions.

5   Conclusion & Outlook

The didactic model of remote internships offers students a learning environment with characteristics similar to those of a Learning Network. Koper (2009) defines a learning network as a technology supported community of people who are helping each other to better understand and handle certain events and concepts in work or life.

If we consider the more 'narrow' definition of Learning Network by Sloep (2009), many characteristics of the remote internships model are quite similar. Sloep (2009) points at the diverse and overlapping communities in an online social network design to support non-formal learning and professional development. The Remote internship didactic model emphasizes the interaction between different communities, i.e. the employers network, the academic community and the professional network contacts of their fellow learners, because of the clearly designed communication structures (tools, reviews) and assessment structures on personal and professional development (Lansu et al. 2009). Although directed to formal learning, the characteristics as described in section 4 show the importance for learners of heterogeneity, flexibility and the interaction on multiple perspectives, as didactic model to gain transboundary competence and – in the mean time – to enhance and enlarge their life long learning network.

The results of the exploration of the characteristics of the applicants who successfully finalized a semester track of the bachelor internship course, shows the heterogeneity needed to support the learners in this online, distributed community. This community of learners does support the students in handling sustainability issues, as it guarantees the heterogeneity and multiple perspectives on the issues needed to develop transboundary competences. At the same time, the heterogeneous teams of students working in interaction with professionals - the employers outside the academy and the university tutors – could be seen as the onset of a learning network, not only within the formal educational programme but also as a non-formal community supporting the transfer of new knowledge and innovative methods relevant to the personal professional development of these adult learners. The flexibility of the academic programme seems to be successful in supporting personal professional development, because a majority of the students has developed the professional career during their study.

In the near future, we will study the results of 10 years networked learning for sustainable development by assessing the available data on learners and learning evidence. We are looking for information on whether heterogeneity in online working in virtual teams supports (professional) learners and helps them to create learner networks, first within formal educational programmes, later perhaps beyond those.

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Proceedings of the 7th International Conference on Networked Learning 2010 , Edited by: Dirckinck-Holmfeld L, Hodgson V, Jones C, McConnell D & Ryberg T

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ISBN 978-1-86220-225-2