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A Decade of Progress on Education for Sustainable Development

Reflections from the
UNESCO Chairs
Programme



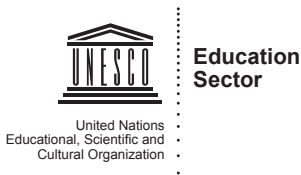
A Decade of Progress on Education for Sustainable Development

Reflections from the UNESCO Chairs Programme

G. Michelsen and P. J. Wells (Editors)

UNESCO Education Sector

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Foreword

As the world enters the second year of implementing the United Nations Sustainable Development Goals (SDGs) and the Education 2030 Agenda, it is both timely and relevant to reflect on the achievements and pressing challenges to emerge in 2015 from the UN Decade of Education for Sustainable Development (ESD).

It is clear from the current comprehensive analysis of progress from the UNESCO Chairs and Inter-university Networks (UNITWIN) that ESD cannot, and does not, function in isolation of each of the global development issues. Indeed, the inter-disciplinary nature of such concerns are intricately inter-woven with each of the seventeen SDGs and demand that education be central to the broader aims of ending hunger, achieving gender equality, ensuring the sustainable management of water as well as sustainable consumption and halting biodiversity loss. Research, solution-finding and good practice are all key to these commitments and therefore the need to harmonize knowledge sharing on common, open, and electronic platforms will play an ever more central role.

Now entering its 25th year, the UNESCO Chairs Programme remains an essential source for the relevant and state of the art knowledge accumulation and sharing across all fields of UNESCO's activities in Education, the Social and Natural Sciences, Culture and Communications. While there is still far to travel at the crossroads between the Decade of ESD and the SDGs – the latter must build on the lessons of the former on the road to addressing the challenges the world is now facing.

The Education Sector applauds the considerable work undertaken over the last ten years by the UNESCO Chairs on Education for Sustainable Development and welcomes the continued close association and collaboration between higher education and research institutions – the Chairholders, their research colleagues and students – and UNESCO.



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I. From the Editors

From Here to There:

The UNITWIN/UNESCO Chairs Programme in the UN Decade of Education for Sustainable Development and the Sustainable Development Goals

Gerd Michelsen and Peter J. Wells

Introduction

In 2002 the United Nations passed a resolution to implement the UN Decade of Education for Sustainable Development for the period 2005-2014, thus launching a global initiative to conceptualize and implement education for sustainable development (ESD) as a key contribution to advancing sustainable development in societies around the world. In a multitude of activities, the Decade of ESD triggered changes worldwide, especially concerning the role and understanding of ESD. If ESD was once seen as more of a niche activity in a greater educational system, this viewpoint has now shifted. Today education for sustainable development is seen as an innovative concept that gives a new meaning to teaching and learning in many different educational settings. Education for sustainable development is no longer an “add-on” in the curriculum alongside environmental, consumer or climate education; instead it is an approach offering an opportunity to fundamentally rethink education. Increasingly this means taking a holistic systems approach, one which assumes that education for sustainable development and the idea of sustainability are not only important for teaching and learning processes but also for the development of educational institutions, whether they are day-care centres, schools, universities or vocational institutions.

The Beginning of Environmental Education to the Global Action Programme

If we look back over the history of educational policy, we see, in the 1970s at the latest, the beginnings of an international discussion about environmental education that was to become an important element

of education for sustainable development. Since that beginning, countless international conferences have taken place with the goal of establishing environmental education in the various areas of education, with the United Nations and its organizations taking a leading role in establishing environmental education worldwide. A milestone in this period was the first global UNESCO conference in 1977 on environmental education in Tbilisi, Georgia (UNESCO, 1977). This conference had a decisive impact on our understanding of environmental education as an integral element of a continuous educational process going beyond school education to lifelong learning. The overarching goals of environmental education were now seen as including raising awareness, acquiring knowledge and competencies, developing attitudes, and enabling participation.

At the same time there was an international discussion — not least triggered by the report of the Club of Rome with the title *Limits to Growth* (Meadows et al, 1972) — about the threats and dangers human beings pose to the conditions of life on earth. This document, along with others such as *Global 2000* (Barney, 1980) or the Brundtland Report *Our Common Future* (United Nations, 1987), made clear that humankind had entered into an unprecedented phase of global change that demanded a new quality in our ability to address human-environmental problems just as much as it demanded new forms of human coexistence. This new understanding of the globality of these changes revealed the existential necessity that humankind use natural and social resources responsibly. It was now no longer possible to speak of education as behaviour adaptation or change; education must become a process leading to individuals taking on personal responsibility for society's development.

The discussions initiated by these publications on the role of education in sustainable development had their next milestone in 1992 at the United Nations Conference on the Environment and Development in Rio de Janeiro. At this Earth Summit, *Agenda 21* was adopted, a document which repeatedly emphasized the importance of education, with Chapter 36 dealing explicitly with education, public awareness and training, including a catalogue of actions for their implementation. This document was to give the discussion about the role of education in sustainable development a central reference point that would play a key role in educational policy initiatives and activities both nationally and internationally in the years to come.

The powerful role that education had been given in *Agenda 21* was reconfirmed ten years later at the World Summit on Sustainable Development in Johannesburg (2002) when in the final declaration and in the action plan the goal was formulated to integrate all aspects of sustainable development at all levels of education, making education a key catalyst for change. This culminated in the proposal for an international UN Decade of Education for Sustainable Development. This recommendation was taken up by the General Assembly of the United Nations and a resolution was adopted to hold a UN Decade of Education for Sustainable Development for the period of 2005-2014. The goal of the Decade was to mobilize educational resources to help implement *Agenda 21*, as adopted at the Rio summit conference and reaffirmed in Johannesburg, by establishing the principles of sustainable development in national educational systems worldwide.

Other key milestone events contributed to the Decade including the 2009 UNESCO World Conference on ESD, culminating in the Bonn Declaration which called on ESD to,

... actively promote gender equality, as well as create conditions and strategies that enable women to share knowledge and experience of bringing about social change and human well-being.

UNESCO has actively supported actions for enhancing and developing the crucial role of women through the UNESCO Chairs and UNITWIN Networks on

gender and women issues as well as ESD, given that vulnerable groups including girls, women, indigenous and coastal populations are hardest hit by impacts of climate change, including the increasing intensity and frequency of extreme weather events and natural disasters.

The final summit meeting of the UN Decade was held in Aichi-Nagoya in November 2014. Its declaration states that:

Leadership is essential for moving from policy commitments and demonstration projects to full implementation across curriculum, teaching operations, whether in formal systems or in non-formal learning and public awareness.

One of the many goals successfully accomplished during the Decade was persuading major actors in the educational sector to take up education for sustainable development. In the final declaration UNESCO Member States pledged to implement a Global Action Programme and called on all stakeholders, especially educational ministries together with other ministries and educational institutions involved in education for sustainable development, to work towards jointly creating knowledge and diffusing education for sustainable development. It states:

... that the Global Action Programme (GAP) on ESD, endorsed by the 37th session of the General Conference of UNESCO as a follow-up to the Decade of ESD and a concrete contribution to the post-2015 agenda, aims at generating and scaling up ESD actions in all levels and areas of education, training and learning.

Beginning in 2015 the Global Action Programme is the follow-up to the UN Decade of Education for Sustainable Development (2015-2019) and is also being held under the auspices of the UNESCO. The goal of the GAP is to launch and intensify initiatives in all areas of education, supporting and advancing the process leading towards sustainable development. The programme specifies five priority areas:

1. The first priority area highlights the crucial role of political policy in advancing a favourable environment for education for sustainable

development to develop its potential to change educational systems. The ESD concept should be mainstreamed in educational and sustainability policy-making and integrated in national and international guidelines in these sectors.

2. The holistic transformation of learning and training settings is the goal of the second priority area. Sustainability is not only something to be taught but instead it must be lived and experienced at the place of learning. This can only come about by changing the values and structures of educational institutions.
3. The third priority area is about building the capacities of educators and trainers. Education for sustainable development should be integrated into the professional training of teachers, enabling them to become “change agents” in implementing education for sustainable development.
4. The fourth priority area focuses on enabling and mobilizing youth. Young people should be empowered to participate more closely in the development of political strategies and their implementation in the area of sustainable development.
5. The advancement of sustainable development at the local level is the fifth priority area of the Global Action Programme. Networks need to be created and developed in local communities, where a variety of stakeholders are able to work together to discuss and exchange ideas about sustainability, thereby also improving the quality of learning platforms. Networking these actors enables them to effectively advance sustainable solutions at a local level of the community and increase and strengthen learning opportunities about sustainable development.

In order to advance these five priority areas, actors in education for sustainable development are encouraged to first make voluntary commitments to implement education for sustainable development and then create partner networks as well as a Global Forum so that they are able to meet regularly and exchange ideas, experiences and information.

A further milestone in the academic and public discussion about sustainable development was achieved in 2015 when the United Nations adopted the Sustainable Development Goals (SDGs). This discussion had its beginning in the publication in 1987 of the *Brundtland Report*, and was continued in 1992 with the UN Rio Summit on the Environment and Development, and it reached its first high point in 2000 with the Millennium Development Goals (MDGs). The MDGs, which were to be implemented by 2015, are largely related to meeting the challenges facing countries in the southern hemisphere. Even though some progress was made in achieving its goals, the results are sobering. Many regions of the world continue to suffer from extreme poverty and hunger. Also in the question of gender equality and rights only very modest progress can be observed. Similarly, the goal to build a global partnership for development has been postponed indefinitely due to the eruption of smouldering armed conflicts and the emergence of new wars.

At the Rio+20 Conference a Post-2015 Development Agenda was launched, calling for the creation of universal goals for a sustainable development of the global community. The SDGs, which were adopted by the General Assembly of the UN in September 2015, apply equally to developing, emerging and industrial countries and encompass the ecological, social and economic dimensions of sustainable development as well as inter- and intra-generational justice. The fourth SDG on *Quality Education* promotes inclusive and quality education for all:

By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes. By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development. (United Nations, 2015)

This goal supports and strengthens the Global Action Programme of the UNESCO and highlights the crucial role given to sustainable development in all areas of education. It also emphasizes that education, gender equity, sustainable development, and a sustainable lifestyle are closely interrelated and must be addressed as a complex whole if progress is to be made. To this end higher education is called on to educate both women and men with the competencies needed to support social change processes.

The five priority action areas identified by the Global Action Programme – in particular the increased efforts to involve young people in the continuing development of practice and research in the area of education for sustainable development – will undoubtedly play a prominent role over the coming years. As a result of the increasing importance being given to these activities, the UNESCO Chairs involved in issues of sustainable development will also be called upon to play a greater role internationally. A closer look at the work of the UNESCO Chairs shows their development until the end of the UN Decade.

UNESCO Chairs in the UN Decade of Education for Sustainable Development

The UNESCO Chair programme was established in 1992 following a decision by the 26th General Assembly of UNESCO to implement the Organization's goals in science and education. There are now over 700 Chairs and Inter-University Networks (UNITWIN Networks) spanning many different disciplines, and 128 countries. This global presence consists of 692 UNESCO Chairs and 50 UNITWIN Networks.¹ The UNESCO Chairs conduct research and teaching on topics that further the goals of UNESCO based on the principles of inter-university cooperation, international networking, and intercultural dialogue. The UNITWIN programme addresses current issues to support sustainable economic and social development and to date UNESCO Chair and UNITWIN Network projects have succeeded in creating innovative and critical new teaching and research programmes,

while stimulating the development of existing university programmes. While the UNESCO Chairs do not receive financial support from UNESCO, many of the Chairs already have a professorship at their institution, and have been awarded the title of UNESCO Chair holder. They are able to then use this status to leverage the necessary funds for projects that are part of their mandate.

In the wake of the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002, the United Nations proclaimed the World Decade of Education for Sustainable Development for the period 2005 to 2014, and tasked UNESCO with its implementation. This UN Decade became an invaluable framework for expanding the UNESCO Chairs programme, as the number of UNESCO Chairs that focus on topics related to sustainable development increased considerably after the initiative came into effect. An analysis of the current list of the UNESCO Chairs and UNITWIN Networks reveals this significant development, as can be seen in Table 1.

For analysis, the UNESCO Chairs with missions relevant to environmental protection and sustainability were selected and counted if the following key words and phrases appeared in the title of the Chair title: '(education for) sustainable development'; 'sustainability'; 'environment(al) (education)'; climate; bioethics; 'global'; 'renewable/alternative energy'; 'anticipatory'; 'transdisciplinary'; or the corresponding terms in French or Spanish. It is particularly noticeable that well over half of the UNESCO Chairs with references to the environment or sustainability are found on the European continent. It is also worthy of note that, approximately 55 per cent of the new UNESCO Chairs with such missions were created during the UN Decade of Education for Sustainable Development.

It is conspicuous that only a small number of UNESCO Chairs were newly established on the African and the North American continents during the UN Decade. It is also conspicuous that there are currently no UNESCO Chairs at all with references to the environment or sustainability, in Australia or New Zealand. If one looks at the country-specific distribution of UNESCO Chairs, Russia (18), Spain (12), Italy (8) and Canada (5) are clearly at the top of the list.

¹ As of 01 June 2016 (retrieved from <http://en.unesco.org/unitwin-unesco-chairs-programme>)

If one takes the total number of all UNESCO Chairs (661), and relates them to the number of Chairs relevant to environment and sustainability (131), then one can see that around a fifth of all UNESCO Chairs are devoted to issues relevant to sustainability and the environment.

This does not take into consideration those Chairs that are concerned with challenges such as desertification or water conflict, and which, therefore, have at least an indirect link to issues of sustainability.

Table 1: Number of UNESCO Chairs with missions that refer to the environment and sustainability by date of establishment

Year/Continent	To 2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total (in the Decade)
Europe	30	1	4	2	3	6	7	4	8	5	3		73 (30)
Asia	4	1		2			1	1	3	1	2		15 (4)
Africa	16				1		1	1					19 (16)
North America	3							1		1	2	1	8 (3)
South America and the Caribbean	7	2						2	3	1	1		16 (7)
Australia, New Zealand and the Pacific													0
Total	60	4	4	4	4	6	9	9	14	8	8	1	131

Source: Authors

A similar situation can be seen concerning the worldwide distribution of the UNESCO Chairs with a more specific reference to education, whether concerning the environment or sustainable

development (Table 2). Sixty per cent of a total of 32 UNESCO Chairs for environmental education, or education for sustainable development, are found in Europe.

Table 2: UNESCO Chairs for environmental education or education for sustainable development by date of establishment

Year/ Continent	Until 2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total (in the Decade)
Europe	7	1	2		1	1	3	1	1	1	1		19 (7)
Asia	1			1				1		1			4 (1)
Africa	1				1								2 (1)
North America	1							1			1		3 (1)
South America and the Caribbean								1	1	2			4 (0)
Australia, New Zealand and the Pacific													0
Total	10	1	2	1	2	1	3	4	2	4	2		32 (10)

Source: Authors

Of the current 32 UN Chairs for environmental education or education for sustainable development, two-thirds were established during the UN Decade. Moreover, of those Chairs newly established during this time, over half are, again, to be found in Europe. A country-specific analysis shows that Sweden has the most UN Chairs with a reference to education (4).

Without attempting to rank or weight their importance, there appear to be a number of possible reasons for this distribution of UN Chairs in different countries and continents. They all have to do with varying degrees or levels in different countries of:

- the perceived importance of UNESCO in general
- the awareness of the UNESCO Chair programme
- the perceived importance of environmental and sustainability issues
- specific interests on the part of the UNESCO or national UNESCO Commissions, which play a role in the establishment of UNESCO Chairs
- the regard for the title “UNESCO Chair”
- financial incentives to establish UNESCO Chairs, which is particularly critical in developing and emerging countries
- academic recognition of UNESCO Chairs in higher education systems
- personal commitment towards the goals of UNESCO by individuals applying for a UNESCO Chair
- perceptions by individual academics of the value of the UNESCO Chair as a means to increasing their scientific impact

There are certainly more reasons that might serve to explain this distribution of UN Chairs. Those listed here only indicate that there is a large spectrum of reasons for the uneven distribution of UNESCO Chairs in different parts of the world.

Conclusions

The UNESCO Chairs, together with UNITWIN projects, made an active contribution to the worldwide UN Decade on Education for Sustainable Development. In particular, in the area of higher education, but also in other educational sectors, the UN Chairs have kick-started a wide variety of interesting activities, as the contributions to this volume demonstrate. Even though a number of UNESCO Chairs focusing on specific issues related to sustainable development, and to education for sustainable development, have been established in several countries over the past few years, it has unfortunately not yet been possible to anchor sustainability in the teaching that occurs in higher education – apart from individual examples, such as Sweden, where higher education institutions are legally required to promote sustainable development. UNESCO Chairs should be given the resources and opportunities to take on even greater responsibility for this area of education, as its graduates play a key role in disseminating ideas about how society should develop, and they make a significant contribution to sustainable development through science and research.

The SDGs mark an important turning point in the focus of the UNESCO Chair and UNITWIN Programme work as well as a challenge to build on their acknowledged achievements. As highlighted earlier, the SDGs place an earnest call on higher education institutions to focus their endeavours on addressing the world's most fundamental developmental issues – not only those related to education but on all areas of human activity – from clean water and healthy living spaces, to peace building, issues of gender disparity and non-discriminatory prosperity. The challenges for the UNESCO Chairs on ESD, and indeed for all the UNITWIN

Networks and Chairs across all fields of activity, is to now use their power of collective creative thought to find solutions to meet these challenges. The Chairs in ESD have now entered a period of consolidation and forward strategizing - a period which requires them to look beyond the theory to the practical and to pertinent problem solving. Turning theoretical knowledge into practice demands them to be at once trans-disciplinary in their implementation design worldwide, to cooperate and collaborate with the wider family of UNESCO Chairs and to urge the full embodiment of ESD into the broader research, teaching and learning higher education agenda towards 2030.

The current publication provides a reference point, reflecting the past achievements of the UNESCO Chairs' diverse areas of thematic focus during the worldwide UN Decade on Education for Sustainable Development, their outlook for the Global Action Programme (2015-2019) and beyond in the context of the Sustainable Development Goals. The editors would like to thank the UNESCO Chair holders and each of the individual contributors for sharing their successes and visions in this crossroads publication and for their continued commitment and dedication to furthering ESD in the new global higher education agenda. We are also indebted to Alexander Leicht and his team in the UNESCO Section of Education for Sustainable Development and Global Citizenship for reviewing the publication, and to the unwavering dedication and cooperation of Liliana Simionescu, Inga Nichanian and Séverine Pillado as coordinators of the UNITWIN/ UNESCO Chairs Programme within the Section for Higher Education.

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II. Policy Reflections and Implications for Education for Sustainable Development: Where are we now?

Transformative Social Learning for Socio-Ecological Sustainability at the Interface of Science and Society:

A Forward-looking Retrospective

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Introduction

This contribution is based on looking back on nearly five years of experience as UNESCO Chair in the area of Social Learning and Sustainable Development. It builds upon two reviews of the United Nations Decade on Education for Sustainable Development that UNESCO commissioned (Wals, 2012), and on a special report on social learning-based ESD, prepared for the end of the Decade of Education for Sustainable Development (DESD) conference (Wals et al., 2014a). I conclude that in order to address the prevailing unsustainability, citizens young and old need to become active participants in transitions that break with prevailing behavioural patterns founded on untenable principles and values. Such transitions demand that more emphasis be placed on transformative social learning to promote socio-ecological sustainability. This 'reframing' of social learning, to make it both transformative and socio-ecological, is crucial when it comes to emphasizing the need for non-consumerist values, and to countering the hijack of sustainability by economic interests and the neo-liberal agenda. This chapter begins with a rationale for seeing learning as a catalyst for change, and innovation with sustainability as a normative framework. The chapter ends with an outline of perspectives and prospects in research and education that support transformative social learning for socio-ecological sustainability. These perspectives and prospects are now at the heart of the renewed Chair at Wageningen University and Research Centre (2015-2020) and the expanding research and education program on environmental and sustainability education at Gothenburg University.

Learning as a catalyst for change and innovation

Despite a decade of ESD momentum, and despite it being well over twenty years since the first Earth Summit in Rio de Janeiro, we find the state of humanity and the planet in continued decline. The urgency of finding a response is greater than ever. As time runs out, the risk increases of resorting to undemocratically decided and authoritatively prescribed measures, which may prolong our stay on planet Earth for a while. For more systemic and equitable solutions, we need to continue to reconsider and re-imagine the role of education and learning in finding ways for people young and old, and the planet, to develop in harmony. Let us assume, for the time being, that there is still time for a learning-based response to the current sustainability crisis. First, we must recognize that a continuous and inescapable problem, for both educators and policy-makers, is that, although we have quite a good sense of what is 'unsustainable', we have little certainty about what, in the end, will prove to be sustainable. Recognizing this suggests that the essence of sustainability-oriented learning lies in the ability to respond, reflect, rethink and recalibrate – and not just once, but repeatedly, when changing circumstances demand it of us. To further complicate things, how this is done, and what kind of society (university, school, neighbourhood, company, city, etc.) this will lead to, will vary from place to place, as no situation is identical.

An epilogue penned by the author for the fourth and final book that appeared in a Dutch government-

supported DESD series on learning and sustainability focused on inter-generational learning and transformative leadership for sustainability (Corcoran and Hollingshead, 2014)¹. In it, I suggest that, given the uncertainties about what is happening, and about what needs to be done, and given the inevitable lack of proven solutions that will stand the test of time and work no matter where, the meaning of sustainability is shifting towards the ability to continuously reflect on the impact of our current actions on people and the planet, here and elsewhere, now and in future times. For me the key lesson from the DESD is that we now recognize that sustainability as such is neither a distant goal, nor a set of behaviours that people can be trained to adopt, but rather a capacity for critical thinking, reflexivity, and transformation. The DESD reviews I referred to earlier show that much 'theoretical work' is being done around the world in the name of ESD, but that this capacity for critical thinking, reflection, and transformation is, in practice, hardly emphasized or developed. As such, ESD unwittingly runs the risk of replicating systems and lifestyles that are inherently. There are those who, for this and other reasons, prefer to use a different concept, such as environmental education (EE), as described in the Tbilisi declaration (UNESCO-UNEP, 1978). It is no surprise that the Environmental and Sustainability Education (ESE) network, launched at the 2014 European Conference on Educational Research, has received a lot of traction. ESE suggests a close relationship between EE and sustainability-oriented education, but also implies that sustainability education has greater resonance than education for sustainability.

Environmental and sustainability education is increasingly connected to education and learning sciences, whereas it once had stronger ties with the sciences of ecology, nature conservation, environmental and sustainability. The main focus of ESE lies in understanding, designing and supporting learning processes that can help people understand complex socio-ecological issues. These issues include, but are not limited to, climate change, loss of biodiversity, food and

nutrition security, rising inequity, and the 'disconnect' between people and places. Typical questions that ESE seeks to address are: how can citizens in their different roles meaningfully engage with such issues? How can the quality of their interactions with, and within, the social, physical and virtual realities of which they are part, be improved? and, what capacities or capabilities are needed to help address these issues, and how can they best be developed? These questions need to be explored in formal (e.g. school-based), and less formal (e.g. community-based) contexts, as well as in blended or hybrid contexts (e.g., workplace learning, community-engaged higher education and citizen science). Much of the work I have been involved in as UNESCO Chair in Social Learning and Sustainable Development builds on a tradition at Wageningen University that started in the 1980s with the emergence of environmental extension, environmental education, and environmental communication. The tradition continued to develop in the 1990s, with biodiversity education, with multi-stakeholder social learning in contexts of natural resource management, and with education for sustainable development.

Important assumptions underlying the work carried out at Wageningen University and at the University of Gothenburg² in the field of education and learning for sustainability, and in its older cousin, environmental education, are that:

1. Education and learning are important in developing people and societies that can prevent and respond to socio-ecological challenges;
2. Education and learning in contemporary societies have a particularly strong role to play in the development of people's cognitive and analytical abilities, in part by helping to make the world more understandable by reducing learning into smaller units (e.g. disciplines, categories, 'molecules'), and modelling how these units can be understood, organized and influenced;

¹ These four books were: *Social Learning Towards a Sustainable World* (Wals 2007), *Young People and Sustainable Development* (Corcoran and Ossano 2009), *Learning for Sustainability in Times of Accelerating Change* (Wals and Corcoran 2012) and *Intergenerational Learning and Transformative Leadership for Sustainability* (Corcoran and Hollingshead 2014)

² Since 2012 the Education and Competence Studies Group (ECS) at Wageningen University has been collaborating with the Department of Pedagogy, Curriculum and Professional Studies of the University of Gothenburg as well as with the Civic Ecology Lab of Cornell University

3. Education and learning in contemporary societies are particularly weak in the development of people's emotional, moral and creative abilities, and their capacities to see relationships, connections and interdependencies.

These three assumptions suggest a particular logic: by taking advantage of the second of them, and by developing the third, the role of education and learning in working towards a more sustainable world (the first assumption) can be strengthened.

Based on these assumptions, and their interrelatedness, future research might focus on the understanding and design of learning processes and learning environments that are conducive to advancing socio-ecological sustainability, as well as on the monitoring and evaluation of these processes and environments. How can we better understand and support forms of learning that can lead to the engagement of seemingly unrelated actors and organizations in establishing new knowledge, and in taking the actions necessary to address socio-ecological challenges? In a piece published in *Science*, we call for 'collaborative research efforts among scientists, educators, and the public, linking science and society with place and identity, through more effective processes of public engagement and learning that can result in meaningful socio-ecological outcomes' (Wals et al., 2014b: 584).

On competence, capacities, capabilities, qualities... and learning

The work of the UNESCO Chair on Social Learning and Sustainable Development has formed an integral, but unique, niche within the Education and Competence Studies (ECS) Group of Wageningen University. In Figure 1 the three dimensions of ECS education and research are represented by overlapping areas that share a focus on competence. The use of 'competence' is under a constant but healthy scrutiny within and outside of ECS. One thing is clear, though: if we are to move towards more integrative approaches to teaching, learning and capacity-building that can help address sustainability challenges, then a static, deterministic conceptualization of competence will not be fruitful. Instead, more

dynamic and holistic conceptualizations appear to be more so. Such approaches consider competence as a relational and emergent property. According to this view, this very property is the result of the 'knowing, learning, and being-in-action' that take place while focusing on an authentic task or meaningful activity. The work done by the UNESCO Chair best fits the transformative/transitional orientation towards sustainable development and global concerns within the context of the typical domains of a life-science university (a category into which Wageningen University falls). As far as competence is concerned, the Chair is exploring the capacities or capabilities needed to transition towards a more sustainable world. We can distinguish, (without seeking to separate these concepts as we develop them), anticipatory thinking, systems thinking, interpersonal skills, and critical thinking, as well as the '*Gestalts*', mind-sets or qualities that are conducive to their development (e.g. empathy, solidarity and agency). Furthermore, the ability to deal with insecurity, complexity, and risk, are considered critical capacities, or competencies, for moving people, organizations, communities and, ultimately, society as a whole, towards sustainability (Wiek et al., 2011; Barth et al., 2007; Rieckmann, 2012).

The education and research done during the past few years, and to be continued in the years to come, covers the heart and the lower right sphere of Figure 1. A close up view of this area reveals that four interconnected and interdependent spheres are in play: frameworks and worldviews (filters or lenses), progressive pedagogies, sustainability competencies, and cooperative learning relationships. The nexus between these four spheres constitutes the landscape of education and transformative social learning towards sustainability.

When looking at the upper-right side of Figure 2, we can identify a number of relevant learning processes that seem particularly suitable for strengthening sustainability, including trans-disciplinary learning, transformative learning, anticipatory learning, collaborative learning, and social learning. Table 1 lists key learning processes relevant to capacity building for sustainable development, as identified in research commissioned by UNESCO (Wals, 2012).

Table 1: Seven non-conventional forms of learning associated with ESD

Type of learning	Short description
Discovery learning	By immersing learners in a rich context where they encounter some element of mystery, they become curious and begin to make sense of their encounter through their own exploration and meaning-making.
Participatory/collaborative learning	Although not identical, both emphasize the interaction between learning, on the one hand, and the active participation of learners in the learning process, on the other. Such approaches tend to focus on resolving a joint issue or task, which can be determined either by the learners themselves, or be decided in advance by others.
Problem-based learning	Learning focused on resolving issues or solving problems, which may be real or simulated, enables a better understanding of the issue or problem at hand. Sometimes, it allows people to find ways to actually make an improvement in real life. In some case the learners themselves determine the issues and/or problems at stake. In other cases, these are determined in advance by others (e.g. teachers, experts, commissioning bodies).
Interdisciplinary learning	Learning that takes issues or problems as a starting point of learning and requires learners to explore them from a range of disciplinary angles, in order to come up with an integrative perspective on improving or resolving them.
Critical thinking-based learning	Learning that exposes, and questions, the assumptions and values that people, organizations and communities live by, and challenges their merit from a particular normative point of view (e.g. animal well-being, eco-centrism, human dignity, sustainability) to encourage reflection, debate, and a rethinking of those assumptions and values.
Systems thinking-based learning	Learning that seeks to see connections, relations and interdependencies in order to grasp the whole instead of just the parts, and to recognize that the whole is more than the sum of its parts. Still, it also seeks to understand that an intervention in one part of the system can affect all the others and, indeed, the system as a whole.
Social learning (multi-stakeholder)	Bringing together people of various backgrounds with different values, perspectives, knowledge and experiences, both from inside and outside the group or organization that initiates the learning process, in order to initiate a creative quest for answers to questions for which no ready-made solutions are available.

(Source: Based on Wals, 2012)

These forms of learning show a high family resemblance in that they:

- consider learning as more than merely knowledge-based;
- maintain that the quality of interaction with others, and of the environment in which learning takes place, is crucial;
- focus on existentially relevant or ‘real’ issues essential for engaging learners;
- view learning as inevitably trans-disciplinary, and even ‘trans-perspectival’, in that it cannot be captured by a single discipline, or by any single perspective;
- regard indeterminacy as a central feature of the learning process, in that what will be learned is

not, and cannot, be known ahead of time with any degree of precision, and that learning-goals are likely to shift as learning progresses;

- consider such learning as cross-boundary in nature in that it cannot be confined to the dominant structures and spaces that have shaped education for centuries (Peters and Wals, 2013).

‘Hybridity’, and synergy, between multiple actors in society, and the blurring of formal, non-formal and informal education, are increasingly considered a pre-condition for the meaningful and effective engagement of people in sustainable development. Opportunities for this type of learning expand with an increased permeability among units, disciplines, generations,

cultures, institutions, sectors and so on. Examples of such learning include citizen science supported by Information and Computer Technology (ICT), place-based education, hybrid learning in vital coalitions, and whole-school approaches to sustainability.

Social learning or transformative learning?

The appeal of social learning in the context of sustainable development can be captured by four key features: 1) the value of difference and diversity in energizing people, introducing dissonance and unleashing creativity; 2) the importance of both reflection and reflexivity; 3) the power of social cohesion and social capital in creating change in complex situations loaded with uncertainty; and 4) the power of collaborative action that strengthens the unique qualities of each individual. The theme of utilizing diversity in learning processes – outlined in the Chair's inaugural address, 'Message in a bottle' (Wals, 2010) – will also be an important one for the renewed Chair at Wageningen University from 2015 to 2020). In this period the Chair is emphasizing transformative learning for socio-ecological sustainability. Again, diversity – including gender diversity – is considered crucial in finding creative, routine-breaking, and counter-hegemonic 'solutions' (at least for the time being), to today's 'wicked' socio-ecological challenges, whose local manifestations are severe. Transformative learning encompasses social learning, but it crucially emphasizes the change necessary for creating a sustainable future. Transformative learning involves 'becoming critically aware of one's own tacit assumptions and expectations and those of others, and assessing their relevance for making an interpretation' (Mezirow, 2009). This 'enables us to recognize, reassess, and modify the structures of assumptions and expectations that frame our tacit points of view and influence our thinking, beliefs, attitudes and actions', Mezirow also notes. By reframing our current work into 'Transformative Social Learning for Socio-ecological Sustainability', we underscore the more prominent role transformative learning and critical reflection, as well as a focus on people and the planet, will play in the years to come.

Key research areas

Although a research agenda can best be designed with the involvement of co-researchers and students, as well as societal partners, the research challenges listed below appear fruitful for generating such an agenda.

1. Identifying key characteristics and indicators of transformative learning configurations

An important question to ask is: what conditions are conducive to social learning in the context of sustainability? George Siemens speaks of a 'learning ecology' to emphasize that connectivity among people is influenced, and can be strengthened, by a number of interrelated factors that, together, form a learning configuration. He uses the concept of connectivism, as complementary to reductionism, to refer to the need for the integration of principles explored by chaos, network, complexity, and self-organization theories (Siemens, 2005). Learning ecology amounts to a networked, facilitated, and mediated configuration of formal and informal forms of learning, revolving around a challenge of change, or of transformation. The learning that takes place is influenced by the filters that learners bring to the configurations (values, perspectives and beliefs), the conduits that facilitate the process (language, media and technology), the various dimensions of learning (from learning about something to learning to transform something), and the different layers of learning concepts (from data to wisdom). During the coming years, we hope to build upon these insights, and to discover new ones, as we actively research a number of 'learning configurations in action' at the crossroads of learning in formal and informal contexts.

An example of such learning is hybrid learning in vital coalitions at the crossroads between schools and the communities of which they are part. This is sometimes referred to as 'whole-school, or whole- institution, approaches towards sustainability' (Hargreaves, 2008; Sol and Wals, 2014; Wals et al., 2014b). Here, schools use the school environment as a starting point for learning about sustainability issues (e.g. issues related to energy, climate, health and nutrition, biodiversity, sense of place), and for building relationships with

local actors and organizations (neighbourhood centres, health authorities, garden centres, local farmers, parents, bicycle stores, etc.). They connect the action and discovery-oriented learning activities to the curriculum, but also to the everyday environmental management of the school. We are particularly interested in understanding the conditions and support mechanisms, and also in determining the effectiveness of such learning arrangements in terms of developing actual sustainability competence.

Hybrid learning, and 'blended learning', are becoming central topics in post-structural educational research that focuses on learning in (often temporary) communities that, while not confined to institutions, operate at the interface between institutional and non-institutional worlds. Wageningen University is seen as one of the places where actual empirical research is done in this area (see for instance Cremers et al., 2013; Sol et al., 2013; and Sol and Wals, 2014).³

2. Describing competencies relevant for sustainable development

Working towards sustainable development involves a number of key capacities that we are only beginning to understand in terms of what they are and how they can best be developed.⁴ This area of research also connects with the European Union's current emphasis on the development of so-called 21st Century Skills. 21st Century Skills generally refer to: a) learning and innovation skills: critical thinking and problem solving, creativity and innovation, systems thinking, communication and collaboration; b) information, media and technology skills: information literacy, media literacy, ICT literacy; c) life and career skills: flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, leadership and responsibility. These skills are connected to 21st century themes and types of literacy including global awareness, entrepreneurial

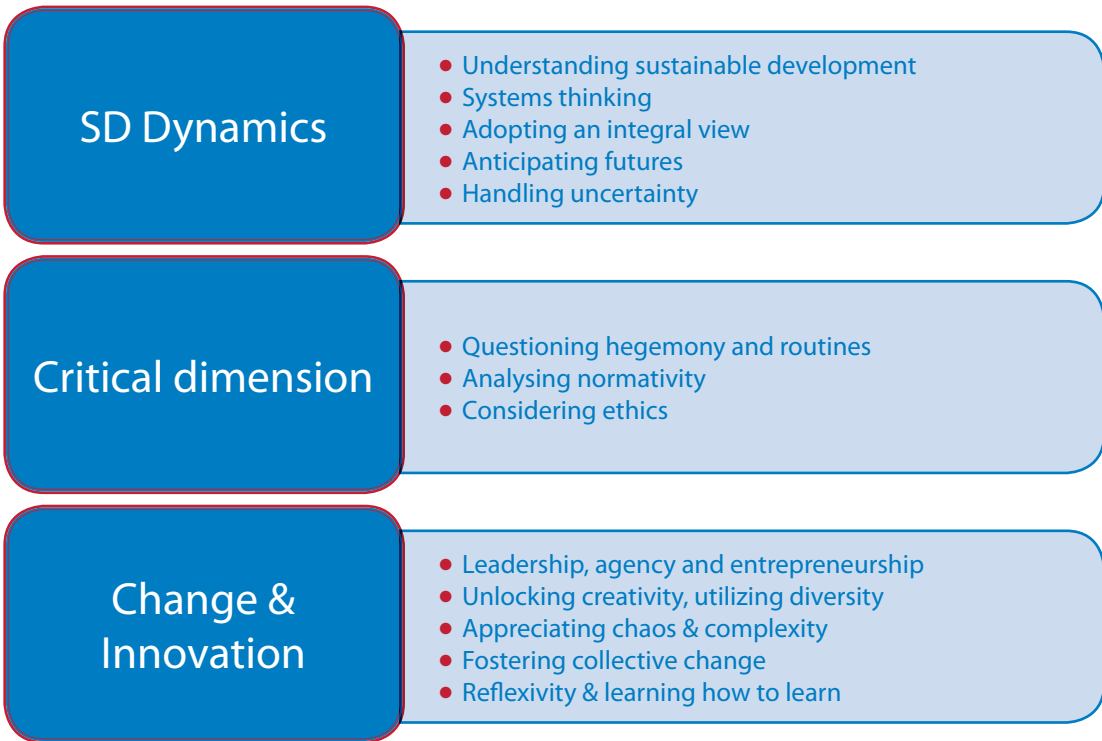
literacy, environmental literacy, health literacy and civic literacy is clear that both the facilitators of, and the participants in, transformative learning in the context of sustainable development will need a certain number of basic competencies. They will need these in order to trigger and support a learning process powerful enough to bring about innovations and transformations that require a change of values, a change of (corporate) culture, a change of lifestyle, and, ultimately, a change in the whole system. But what do these competencies look like and how can they be developed? Based on some of the earlier work we have done in this area, Figure 5 identifies three key areas, and lists a number of associated qualities and capabilities that will need to be developed.

Today, a lot of attention in a number of fields is being directed toward capacity building and competence development for sustainability. Journals in the education and learning sciences, in natural resource management, and also in the area of business development and management studies, are publishing research on this phenomenon.

³ NJAS recently published a special issue on this topic titled: Social learning towards sustainability: problematic, perspectives and promise (Rodela et al. 2014).

⁴ (source: http://www.ims.gov/about/21st_century_skills_list.aspx).

Figure 1: Sustain-“ability”: Key components, qualities and capacities for contributing to sustainable development



Source: based on Wiek *et al.*, 2011

3. Exploring the role of ICTs and ICT-supported citizen science in strengthening socio-ecological sustainability

There is an urgent need to study ways in which ever-present technologies and cyberspaces can be used to help people (re)gain a deeper and more empathetic contact with each other and with the world (at the moment, these technologies and spaces, used inappropriately, tend to lead to the exact opposite outcome). One area of interest is the active involvement of citizens, young and old, in the monitoring of local socio-ecological issues by collecting real data (using, for instance, apps and sensors installed on smart phones), and then sharing this data, through social media and online platforms, with other people who are doing the same thing elsewhere (Wals *et al.*, 2014b).

Educational development and innovation

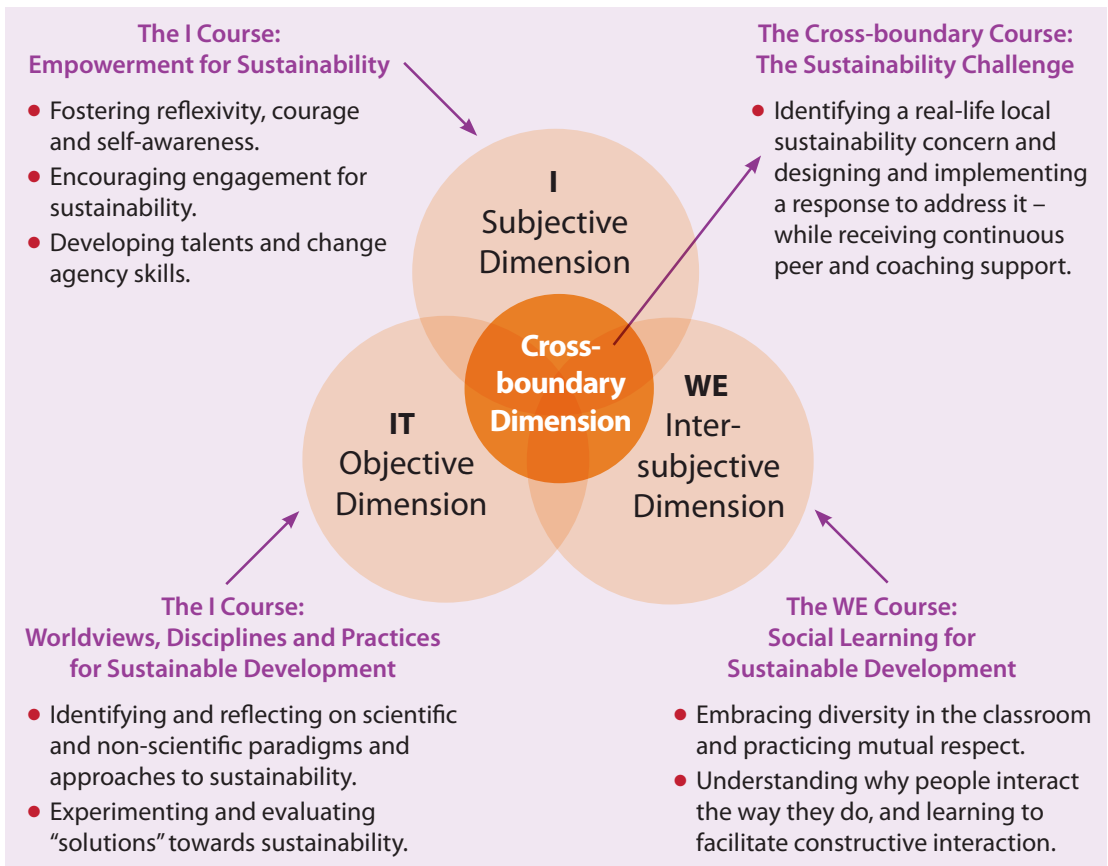
The Chair will continue to contribute to the transformation of education within Wageningen University, the University of Gothenburg and beyond. One key activity will be the development of an online international Master's degree in Environmental and Sustainability Education (ESD), which is due to start in September 2016. The Initiative for Transformative Sustainability Education (ITSE), developed with staff and students at Wageningen in 2011, will guide educational development in the years to come (Wals 2011). ITSE's main concern has been to develop a framework for transformative sustainability education that addresses not only theoretical knowledge and practical skills, but also guides students to question their values, attitudes and behaviours, enabling them to empower themselves.

It also facilitates social and collaborative learning among a diversity of stakeholders. In a nutshell, ITSE strives to enable students to enact sustainable development within their own (expanding) sphere of influence.

ITSE differentiates between four dimensions of education, which must be in balance to promote transformational learning (Figure 6):

- The subjective ‘I’ dimension pertains to the personal development needed to become actively engaged with sustainable development;
- The objective ‘it’ dimension refers to theoretical and applied approaches to sustainable development;
- The inter-subjective ‘we’ dimension focuses on collaborative competencies for working in interdisciplinary environments;
- The cross-boundary dimension integrates the ‘I’, ‘we’, and ‘it’, through experiential, project-based learning, similar to the Wageningen Academic Consultancy Training. This approach is drawing international interest from other universities.

Figure 2: The ITSE framework for sustainability in education at Wageningen University



Source: Author.

ITSE recognizes that people learn from their total environment, which should be designed to create interaction and creativity. The IT course encourages students to develop reflexive awareness of the legitimacy of multiple scientific and non-scientific

perspectives on sustainability issues, and to develop awareness of the complementarities and contradictions between these perspectives. In this way, students develop a meta-awareness of transformative agents and processes, and ways to analyze and contribute

to sustainable development. During integrative coursework, students explore, in depth, a sustainability topic that fits with their personal interests and development goals.

Finally, the development of 'sustainability didactics' within teacher education and professional development is another area that needs more attention in the post-DESD years. This area of research links closely with education in more formal settings (e.g. in schools), where sustainability competences at the crossroads of science education, environmental education and sustainability education are being developed. To support these, new educational approaches (e.g. 'Creative Sustainability Investigations') and activities (e.g. 'Deconstructing a Happy Meal' and 'How smart is your smart phone?') will need to be designed and evaluated.

Final remarks

In the post-DESD Global Action Programme on ESD, the importance of education serving people and the planet, rather than just serving the economy, needs to be emphasized much more strongly than was the case during the DESD. The current push for innovation, competence, life-long learning for work, and competitiveness, is resulting in educational marginalization and the squeezing out of place-based learning, arts, humanities and the development of values other than those driving consumerism and materialism. Our schools and universities are at risk of becoming an extension of economic globalization as they regress into a culture of accountability, outcomes and efficiency. Environmental and sustainability education are being challenged to counter this trend by reclaiming and supporting a culture of learning, critical thinking and curiosity. Fortunately, there are some schools and universities that are beginning to make more systemic changes towards sustainability by re-orienting their education, research, operations and community outreach activities all simultaneously or, which is more often the case, a subset thereof (see for instance the work done in the context of the 'CoDeS' initiative involving schools and communities, or in the Living Knowledge Network in the context of universities and communities).⁶

At the same time, our universities will need to strengthen what we might call 'engaged scholarship with a planetary conscience'. With the increasing complexity of societies, the interdisciplinary nature of people-society-environment relationships, the local and global scale of problems, and the uncertainty of their solutions or resolutions, there is a need for new spaces for collaborative and transformative approaches to education, research and societal engagement. Such spaces need to be created particularly in higher education, where some of the brightest people on Earth gather, and could direct their collective wisdom towards healing the Earth rather than contributing to its rapid demise.

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⁶ More information about CoDeS can be found at: www.comenius-codes.eu/, while more information about the Living Knowledge Networks can be found at: www.livingknowledge.org

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Quality Education and Education for Sustainable Development

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Activities of the UNESCO Chair at York University

The UNESCO Chair at York University on Reorienting Teacher Education to Address Sustainability has wholly dedicated its efforts to promoting and implementing education for sustainable development (ESD) during the United Nations Decade of Education for Sustainable Development (DESD) from 2005 – 2014.

A Brief History of the UNESCO Chair in ESD at York University

During the 1990s, UNESCO identified teacher-education institutions, and teacher educators, as key change agents in reorienting education to address sustainability. Subsequently, in 1998, the United Nations (UN) Commission on Sustainable Development (CSD) work programme on Education for Sustainable Development called for UNESCO to develop guidelines for reorienting teacher training to address sustainability. In order to accomplish this task, in 1999 UNESCO and York University, Toronto, Canada, agreed to establish a UNITWIN/UNESCO Chair to provide advice to UNESCO and institutions of teacher education. The task of developing guidelines for the reorientation of teacher education was passed to the UNITWIN/UNESCO Chair at York. As a result, one of the long-term goals of the UNITWIN/UNESCO Chair was to develop guidelines and recommendations for reorienting teacher education and the associated realms of pedagogy, curriculum, and other related issues (UNESCO 2005a:12).

In order to inform the development of the aforementioned guidelines, the UNESCO Chair formed the International Network of Teacher Education Institutions (TEIs). The network started with 35 TEIs in 30 countries and has now expanded to include more than 70 countries, with hundreds of TEIs in regional, national, and local networks. The International Network meets biennially. The overall budget is approximately US\$100,000 per biennium, in addition to thousands of dollars of in-kind services and volunteer labour by member institutions, ministries of education, and other associated professionals.

The work of the UNESCO Chair has evolved over the years, since it was established in 1999. In the early years, the Chair advocated for and promoted ESD. The Chair used a strategy of face-to-face meetings supported by publications. The UNESCO Chair-holder, Charles Hopkins, spent most of the years leading up to the DESD, and during the UN Decade, travelling widely to attend conferences, give speeches, and attend meetings. To reinforce his messages, he left a trail of publications, and of references to free ESD publications online. From the Chair's perspective, two publications were pivotal to advancing ESD: *Education for Sustainable Development Toolkit* (McKeown, et al. ,2000 and 2002), and *Guidelines and Recommendations for Reorienting Teacher Education to Address Sustainability* (UNESCO, 2005a).

The need for such publications was evident at the UN Commission on Sustainable Development (CSD) meetings in New York during the 1990's. Although many diplomats

who attended the CSD meetings in New York thought ESD was important for achieving sustainable development, few understood how the education of the day was different to ESD. Lack of clarity was a problem throughout the education community, and an ESD community was yet to form. The Chair attempted to clarify ESD, and encouraged the development of the *Education for Sustainable Development Toolkit*. The *Toolkit* was pivotal for two reasons: (1) it was distributed free online to a global audience; and, (2) it explained ESD in simple, easily understood language. The framework for ESD – knowledge, skills, perspectives, values, and issues – became widely accepted, as did the four ‘thrusts’ of ESD (See Box 2). Thrusts one and two primarily involve formal education. Thrusts three and four are mainly concerned with non-formal and informal education. Addressing all four thrusts of ESD requires actions by the formal, non-formal and informal sectors of the education community (UNESCO, 2012a, pp. 33-34).

Box 1: The Four Thrusts of ESD

ESD has four thrusts, or areas of emphasis:

1. Improving access and retention in quality basic education

Enrolling and retaining both boys and girls in quality basic education is important to their well-being throughout their lives, and to the society in which they live. Basic education focuses on helping pupils gain knowledge, skills, values and perspectives that encourage sustainable livelihoods, and on helping citizens to live sustainable lives.

2. Reorienting existing educational programmes to address sustainability

Reorienting education requires revising education from early childhood care to higher education. It requires rethinking what is taught, how it is taught, and what is assessed, with sustainability as the central theme. This process is future-oriented because the pupils of today will need to be able to address the challenges of tomorrow, which will require creativity as well as analytical and problem-solving skills.

3. Increasing public understanding and awareness of sustainability

Achieving the goals of sustainable development requires citizens who are knowledgeable about sustainability, and about the daily actions necessary to help achieve community and national sustainability goals. These citizens will require widespread community education, and responsible media that are committed to encouraging an informed and active populace to learn throughout life.

4. Providing training to all sectors of the workforce

All sectors of the workforce can contribute to local, regional and national sustainability. Employees in both the public, and the private sectors, should receive ongoing vocational and professional training infused with the practices and principles of sustainability, so that all the members of the labour force can access the knowledge and skills necessary to make decisions and work in a sustainable manner.

The second publication that was pivotal to the Chair was *Guidelines and Recommendation for Reorienting Teacher Education to Address Sustainability*. Prior to the DESD, the UNESCO Chair built the International Network of Teacher Education Institutions (TEIs), to begin the work of reorienting teacher education in 30 countries around the world. This network carried out action research on how to reorient teacher education to address sustainability. Working within their own spheres of influence, the network began to understand the challenges, barriers, and opportunities of this endeavour. After three years of work, the Chair surveyed the network about their experiences with the collective wisdom of the group being published in the aforementioned *Guidelines*.

In preparation for the DESD, Canada formed a DESD working group and the Chair-holder of the UNESCO Chair at York, was invited to be a co-chair. During the UN Decade, the Canadian Commission for UNESCO became the national focal point for the DESD. Consequently, the Chair continued to be central to Canadian ESD and DESD activities and meetings.

Currently, the work of the Chair has four focus areas:

1. **Reorienting teacher education to address sustainability.** The Chair works with the International Network of TELs with members of the network implementing ESD and conducting action research. At biennial meetings, members share their progress, insight, and challenges.
2. **Sustainability and Education Academy (SEdA).** SEdA provides ongoing professional development for administrators, teachers, and staff of school systems, with the goal of reflecting sustainability in all of the activities of the system (e.g. teaching, hiring, purchasing, transportation, physical plant maintenance, and waste management).
3. **Research on ESD and quality primary and secondary education.** The Chair, along with the Asia-Pacific Institute in Beijing, China, convenes researchers from 15 countries that score highly on PISA (Program for International Student Assessment), to explore ESD's contribution to quality education from many perspectives.
4. **Research on ESD and improving the education of youth from indigenous and traditional societies.** The research is being carried out in 17 countries on five continents.

The remainder of this paper explores the link between ESD and a quality basic education (i.e. primary and secondary education). The paper also builds a case for promoting and advancing research on ESD's contribution to quality education.

Quality education

Every Ministry of Education strives to provide a quality education for its citizens. Discussions, policies, practices, and assessments revolve around the concept of quality. The aspects of quality that education for sustainable development (ESD) brings to education are now part of the growing international discourse on education. ESD contributes to quality education in many ways. This paper focuses primarily on a framework for quality and on ESD pedagogy.

Over the course of the UN DESD, the perception of ESD has changed. At the beginning ESD was perceived as yet another societal issue to be added to the curriculum, or as another type of so-called 'adjectival education' (UNESCO 2012a; UNESCO 2012b). Now, global sustainability is better understood as a purpose or outcome of educational systems and ESD has entered the discourse as a crucial element in a quality education.

Quality in education has been a part of the educational discourse for years. In 2000, countries of the world met at the World Education Forum in Senegal, where they affirmed an ongoing commitment to Education for All (EFA), and agreed upon the Dakar Framework for Action. The Framework had six goals, including Goal 6, which foresaw 'improving every aspect of the quality of education, and ensuring their excellence, so that recognized and measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills' (UNESCO, 2000, p. 17).

Quality education linked with education for sustainable development

In 2005, UNESCO published a document *Contributing to a More Sustainable Future: Quality Education, Life Skills and Education for Sustainable Development*. This document went beyond the traditional EFA goal of working with developing countries to addressing all nations, by linking quality education and ESD. Additionally, the document linked educational quality to well-being.

Quality education is an effective means of fighting poverty, building democracies, and fostering peaceful societies. Quality education empowers individuals, gives them more of a voice, unlocks their potential, opens pathways to self-fulfillment, and broadens perspectives, opening people's minds to a pluralist world. There is no one definition, list of criteria, definitive curriculum, or list of topics for a quality education. Quality education is a dynamic concept that changes and evolves with time and changes in the social, economic, and environmental contexts of place. Since quality education must be locally relevant and culturally

appropriate, it will take many forms around the world (UNESCO, 2005b, p. 1).

The document lays out ten key aspects of a quality education – five at the individual learner level, and five at the system level.

The key aspects at the learner level are:

- Seek out the learner;
- Acknowledge the learner's knowledge and experience;
- Make content relevant;
- Use many teaching and learning processes, and;
- Enhance the learning environment.

The key aspects at the educational system level are:

- Creates a legislative framework;
- Implements good policies;
- Builds administrative support and leadership;
- Requires sufficient resources, and;
- Measures learning outcomes (UNESCO, 2005b).

These aspects of a quality education have parallels in ESD. For example, 'seek out the learner' aligns with the first thrust of ESD – improving access and retention in a quality basic education. Meanwhile, 'using many teaching and learning processes' is also important for implementing ESD in the classroom. 'By using a variety of teaching techniques, teachers help pupils employ and develop different learning processes. With variety, pupils have a chance to grow as learners and to enhance their skills and capacity to learn and think' (UNESCO, 2012a, p. 15).

In the beginning of the DESD, discussion focused on the possible contributions of education, public awareness, and training, to creating a more sustainable future. In the latter part of the UN Decade, the conversation

shifted to utilizing sustainability to repurpose and revitalize education. A synergy between the quest for quality education, and creating just, thriving and sustainable societies around the globe, is now apparent.

Not only does education contribute to sustainable development and the transformation of society but the reverse is also true. Sustainability improves education, and has the potential to transform education. As countries and communities struggle to cope with contemporary challenges accompanied by major life-changing events (e.g. drought induced by climate change, or a rise in the sea level), the purpose and the relevance of education itself have been questioned (UNESCO, 2012a, p. 36).

Sustainability thus:

- Adds purpose to education;
- Gives a common vision to education;
- Gives relevance to the curriculum;
- Raises the economic potential of students;
- Gives concrete examples for abstract concepts, and;
- Saves pupils' lives (e.g., by preparing them for action in the event of natural disasters) (UNESCO, 2012a, p. 36-37).

Evidence-based decision making, and the need for research

Evidence-based decision-making is a common theme in the international education community (OECD, 2007). As a result, boards of education, school leaders, ministries of education, and other educational decision-makers, search for evidence (e.g., data from assessments, and findings from research studies), on which to base their decisions. Evidence of the ways ESD contributes to a quality education is needed (e.g. by improving student-learning outcomes, or by increasing student engagement), so that the governments can formulate policy to support ESD, as well as providing

financing, and the other key aspects of a quality education.

The need for research linking ESD to quality education is documented in the findings section of the executive summary of the 2012 monitoring and evaluation report of the DESD.

More research is needed to document the idea that ESD is quality education. Much anecdotal evidence exists that ESD is related to academic gains as well as to boosting people's capacities to support sustainable development. Research will provide a solid evidence base and firmly establish that ESD is quality education (UNESCO, 2012b, p. 5).

In April 2013, the UNESCO Chair, in collaboration with the working committee on ESD of the Chinese National Commission to UNESCO, invited researchers from 12 primarily high-scoring PISA countries to discuss conducting research related to ESD's contributions to quality education. The researchers agreed to answer five questions:

1. How can ESD update and improve educational purposes and outcomes?
This question pertains to traditional perceptions of quality and better outcomes. Can ESD improve test scores and/or achieve other desired outcomes (e.g. improved student attendance and problem solving skills)?
2. How can ESD help to improve and enrich school curriculum development?
This question pertains to the relevance of current curricular content, as well as to students' intellectual engagement with the content.
3. How can ESD guide students towards acquiring the knowledge, skills and values necessary to care for, and solve, the sustainable development issues that will arise in their lifetime?
This question pertains to educating people for an uncertain future and to deal with the complexity of future challenges to global sustainability.

4. How can ESD help strengthen the partnerships between schools and other stakeholders, including the surrounding community?

This question pertains to the usefulness of the school to its local community and vice-versa.

5. How can ESD promote innovation in the teaching-learning conceptual framework?

This question pertains to improving our understanding of how teachers learn to teach throughout their careers, and how to engage learners to master the curricula.

The research team met again in May 2014 in Beijing, hosted by the Shijingshan District of Beijing, China. A quick analysis of research reports on these five questions, from eight countries, (i.e., Canada, China, Germany, Japan, Peru, Sweden, Taiwan, and the United States), and one international network of educators in Europe, showed that, in schools where ESD is being thoughtfully practised, it is bringing about change - small and large changes associated with education quality. Preliminary findings for each of the research questions include, but were not limited to:

1. How can ESD update and improve educational purposes and outcomes?
ESD has updated and expanded upon the conception of qualities that are desirable to develop in students (e.g. international awareness, stewardship, anti-anthropocentrism, and empathy.)
2. How can ESD help to improve and enrich school-curriculum development?
Sustainability in the curriculum has made curricular content more relevant to the lives of students. Furthermore, it increases students' engagement in the material studied and their motivation.
3. How can ESD guide students towards acquiring the knowledge, skills and values to care for, and solve, the sustainable development issues that will arise in their lifetime?
ESD initiates institutional changes and promotes learning outside of the formal curriculum and the classroom. It also inspires students to participate in the creation of solutions for the future. In addition, ESD provides students with opportunities to work

in realistic situations with concrete ideas and tasks that foster problem solving skills, responsibility, and cooperation. Working on concrete sustainability tasks has fostered hope, empowerment, and agency.

4. How can ESD help strengthen the partnerships between schools and other stakeholders, including the surrounding community?
ESD-related projects can serve as a bridge for powerful school-community partnerships and student learning. Whole-school approaches, service learning, community gardens, and classroom assignments that involve studying the local community, have helped bring the community into the classroom, and have taken students out of the classroom and into the community.
5. How can ESD promote innovation in the teaching-learning conceptual framework?
ESD is supporting efforts for trans-disciplinary teaching and learning. ESD has also stimulated the use of student-centered pedagogies that encourage participatory learning and cooperation. Furthermore, it has encouraged the development of critical thinking and communication skills. Although ESD promotes innovation, teachers do not intrinsically know how to innovate, and professional development is necessary.

A report on the research findings on ESD and quality education from this meeting (2016) includes findings of researchers from Australia, Korea, Mongolia, and the United Kingdom, who also attended the aforementioned meeting.

Research confirming ESD's contributions to quality education will not be completed by the end of the DESD, but the initial findings are most encouraging. Nevertheless, the need for research required for evidence-based decision making to support ESD will extend beyond the end of the DESD. As a result, research on ESD and quality education must be a priority for post-2014 ESD initiatives.

Box 2: Finland's curriculum revision: Ongoing attention to quality education

- Finland, which is considered to have one of the world's more successful education systems, has been revising its national curriculum. This revision process is heavily based on a broad public consultation that includes teachers and school leaders. Revision occurs approximately once every 10 years. In this most recent revision cycle, there has been extensive support for a greater role of ESD in the new curriculum.
- Finland sees sustainability through the lens of well-being, and this is reflected in the new vision for the curriculum. We can learn more about the Finnish approach from the following:
- Our aim is to enhance pupils' coherent identity and positive self-conception, develop their generic competences and subject-specific knowledge and skills, and, through that, help pupils to develop themselves as humans and citizens **who are able and willing to live in a sustainable way and build a sustainable future.** ... We also say that our schools have to develop their working culture so that by their own activities **they both exemplify, as well as promote, sustainable well-being** - Irmeli Halinen, Finnish National Board of Education (I. Halinen, personal communication, 16 April 2013).
- Finnish teacher-education institutions are also deeply engaged in the curricular revision process. Members of the Faculty of Education at the University of Eastern Finland have been researching academic well-being and writing up their findings.

ESD pedagogies contribute to quality

Along with changes to curricular content, ESD is changing teaching and learning processes. ESD is ushering in new pedagogies that 'stimulate pupils to ask questions, analyze, think critically and make decisions'

that are cooperative rather than competitive, and are student-centred rather than teacher-centred. ESD pedagogies move instruction from rote memorization to participatory learning (UNESCO, 2012b, p. 15). ESD pedagogies also move beyond the classroom, and into the community (Ferreira et al., 2006; Jiménez and Martin 2007; Down, forthcoming).

Good classroom practices associated with ESD include a variety of teaching techniques that engage students through different learning modalities (e.g. visual, auditory and tactile-kinaesthetic). Using a variety of teaching techniques helps to ensure quality.

A quality education implies that the needs of individual learners will be considered and addressed in developing and delivering lessons. By using a variety of teaching techniques, the teacher attends to the diverse needs of the pupils in the class. Not all students learn in the same way. Some prefer to listen, others to read, and still others to participate more actively. Unfortunately, traditional pedagogies mainly serve pupils who are good at listening, reading, memorizing and sitting still; however, not all pupils have these abilities. Yet education is for all (UNESCO 2012a, p. 15).

Using a variety of teaching techniques also addresses equity, which is one of the grand challenges of social sustainability.

Meeting the learning needs of all pupils in the classroom is a form of social equity, which is a core concept of sustainability. For many years, the educational community did not link teaching techniques with social equity. Previously, only the pupils who were good at reading, memorizing and reciting excelled in school. Those pupils who were not did not thrive in school often dropped out, thereby limiting their careers and economic potential. Dropping out of school is a major social and economic sustainability issue. However, using a variety of teaching techniques to meet the learning needs of pupils can address equity in the classroom. Such practice also demonstrates to the pupils a form that equity and social sustainability can take. Pedagogies used in school, like other educational practices (e.g. a whole-school approach to sustainability), can, therefore, promote principles of sustainability (UNESCO, 2012a, p. 16).

ESD pedagogies do more than facilitate the acquisition of knowledge; they also promote the learning of skills, perspectives and values.

The publication *Education for Sustainable Development: An Expert Review of Processes and Learning* (Tilbury, 2011) identified a number of learning processes that are used in higher education and that are perceived to be related to ESD. They include: simulations, group discussions, critical incidents, case studies, critical reading and writing, problem-based learning, fieldwork and outdoor learning, etc. Over the UN Decade, several teaching and learning techniques grew in popularity. For example, service learning is associated with ESD (Jiménez and Martin, 2007), as is using ecological footprint calculators to help students to recognize their impact on the planet (O’Gorman and Davis, 2013). School gardens are growing in popularity (UNESCO Associated Schools, 2009). Dealing with complex sustainability issues that have environmental, social and economic roots, as well as controversial issues in the classroom, is an important part of schooling today, to prepare the voting citizens of tomorrow (Clarke, 2000; Humes, 2010; McKeown-Ice and Dendinger, 2008; McKeown and Hopkins, 2010). Many of the pedagogies associated with ESD have been around for years within different disciplinary traditions. Because of its interdisciplinary nature, ESD brings together knowledge from across the different academic disciplines. This interdisciplinary aggregation does not stop at knowledge. ESD also aggregates pedagogies, especially active and participatory learning and teaching techniques.

ESD pedagogies contribute to the first thrust of ESD – improving access to, and retention of, quality basic education. Quality basic education cannot be achieved without attention to pedagogy. In addition, ESD pedagogies contribute to the second thrust of ESD – reorienting existing education programs to address sustainability. Reorienting education includes learners building new skills. These skills are developed, and practiced, through student-centred and participatory-learning ESD pedagogies. The teaching and learning techniques of previous generations (e.g. lectures and memorization) will not be sufficient to deal with the complexity and uncertainty of the future, or bring about the profound societal changes that are needed

in the search for a more sustainable future. 'Education for Sustainable Development requires far-reaching changes in the way education is often practised today' (UNESCO, 2012c).

Moving forward: the urgency and challenges

**If we teach today's students
as we taught yesterday's, we are
robbing them of tomorrow**

John Dewey

As they seek to provide a quality education in a rapidly changing world, in which major challenges to sustainability are confronting our communities and our countries, Ministries of Education face enormous challenges. Indeed, a sense of urgency pervades Ministries of Education and other educational organizations, a sentiment echoed in the following:

I have been left with a greater sense of urgency about the necessity to improve the education of our children by better supporting the development of their higher-order thinking skills and their ability to apply these skills effectively to a broad range of problems. It is, in part, these skills that will enable them to invent and contribute to the new world (Wilhoit, 2011, p. viii).

The list of challenges that threaten local and global sustainability is lengthy; such challenges are captured in the Bonn Declaration.

The global financial and economic crisis highlights the risks of unsustainable economic development models and practices based on short-term gains. The food crisis and world hunger amount to an increasingly serious issue. Unsustainable production and consumption patterns are creating ecological impacts that compromise the options of current and future generations, and indeed the sustainability of life on Earth, as climate change is demonstrating (UNESCO and the German Ministry of Education and Research, 2009, p. 1). To a large extent, it is these challenges that will shape a new definition of quality education and its implementation.

These challenges motivated the UNESCO Chair at York University, and others as well, to work diligently throughout the DESD. The scope of activities and geographic engagement of the UNESCO Chair at York has grown over the years. While reorienting teacher education remains the core of the Chair's mission, the Chair and secretariat have learned that changes to teacher education cannot be addressed in isolation. Our mission has led us to identify strategic leverage points for action within formal education, and to engage with ministries of education, school systems, and higher education, in addition to faculties of education. Working to bring about change in teacher education in today's world requires a lot more than updating content taught in classrooms in TELs. Enduring change requires multiple interventions throughout the formal-education community.

Latest step: the global action programme in ESD

As the lead UN agency for the DESD, UNESCO began planning for the end of the DESD, and for a post-Decade process, several years in advance. The UNESCO Executive Board directed staff to explore and identify possible post-Decade options to continue ESD activities. UNESCO consulted with its Member States to identify their needs and preferences related to ESD. Broad consultation and further action by the Executive Board and the General Conference resulted in the Global Action Program of Education for Sustainable Development (GAP).

"The overall goal of the Global Action Programme is to generate and scale up action in all levels and areas of education and learning to accelerate progress towards sustainable development" (UNESCO, 2013, p. 1). The GAP has five priority action areas: policy support, whole-institution approaches, educators, youth, and local communities (UNESCO, 2013). During the GAP, the UNESCO Chair at York will work primarily on the third priority action area: educators. Still, the Chair will also work with key partners and the coordinating forum in the priority action areas of policy support and whole-institutional approaches where their activities apply to primary, secondary, and teacher education. This should

help to promote multiple interventions that support reorienting teacher education to address sustainability.

For the post-Decade process in ESD, the UNESCO Chair at York will continue to emphasize ESD's contribution to quality education in the hope of maintaining ESD's upward trajectory in the formal sector of the education community. It is through the concept of quality that ESD will be accepted and will stay on education ministries' radar screens. Firmly establishing ESD's contribution to quality education will prevent ESD from being replaced by the next educational trend that promises to address the ills of educational systems or society.

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Recommended viewing for educational decision-makers:

UNESCO. 2012c. *Education for Sustainable Development: Building Support Systems (Video)*. Paris, UNESCO. (http://www.unesco.org/archives/multimedia/index.php?s=films_details&id_page=33&id_film=2589)

Sustainable development as a guideline for higher education:

An innovative concept for teaching and learning

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Introduction

Higher education institutions are key actors in processes of social change and development (Brennan et al., 2004). Sustainability, however, as a complex, integrative, and normative guiding principle, is still outside mainstream structures in both the scientific and the educational domains. The issues of higher education and curriculum-renewal in the context of sustainability have long been neglected by higher education institutions in favour of other research and transfer activities and thus at the expense of a much needed development of general education.

Higher education for sustainable development (HESD) 'is based on values, principles and practices necessary to respond effectively to current and future challenges' (UNESCO, 2009). Students should be supported in acquiring (key) competencies, which help lead to a sustainable, future-oriented society. These include skills for creative and critical thinking, oral and written communication, collaboration and cooperation, conflict management, decision-making, problem solving and planning, using Information and Computer Technology (ICT) appropriately, and practical citizenship. Achieving this goal requires a re-examination of educational policy in order to foster the development of the knowledge, skills, perspectives and values related to sustainability (UNESCO, 2006).

Academic education is thus challenged by the need to initiate specific learning processes, which require new approaches to teaching, learning and assessment. A new and innovative learning culture is needed, one which, for example, requires in teaching and learning:

- A complex problem-oriented approach;
- A central role of inter- and trans-disciplinarity, and;
- Corresponding supportive conditions for thinking and learning processes, including self-directed learning and collaborative learning.

The changes initiated by the Bologna Process, especially regarding the modularization of programmes of study, as well as the introduction of a three-cycle degree system, have offered, and continue to offer, numerous opportunities during this process of reorienting higher education to involve, and to integrate, aspects of sustainable development.

The UNESCO Chair on Higher Education for Sustainable Development (HESD) at Luephana has been working intensively to implement these principles in academic teaching and scientific learning at regional, national and international levels, and to stimulate a debate about the meaning of sustainability as a paradigm for higher education institutions.

This article begins by introducing some conditions for higher education for sustainable development (SD), outlining briefly the Chair's working areas, and finally giving an example of how the principles of HESD can be wholly integrated into a curriculum.

Conditions for higher education for sustainable development

The path to a sustainable development is a process requiring people to act autonomously and be critically reflexive. 'Teaching sustainability' would, therefore, be a method that would miss its target. The goal of promoting the acquisition of the requisite knowledge and competences is instead accompanied by a shifting of learning objectives from more abstract, to more practical forms of knowledge, such as systems knowledge, or knowledge of using different methodologies. This is especially true for the setting in which learning takes place, as competencies cannot be taught, but must instead be learned (Weinert, 2001; Esholz, 2002).

There is much discussion in the literature about the various learning objectives and competencies necessary in higher education for sustainable development (see, for example, Barth et al., 2007b; Barth, 2015 Michelsen, 2014; Stoltenberg and Burandt, 2014). Despite some differences, there is also much common ground in considering that learning settings in (higher) education for sustainable development must fulfill certain conditions:

i) Dealing with complexity

Society is increasingly confronted by problems that are characterized by their inter-relatedness and their growing momentum, by their complexity, and by their ambiguous and, at times, contradictory objectives (Dörner et al., 1994). The challenge for higher education is for students to learn about the changeability of such complex problems, so that they can come to better know and understand societies and their development. Addressing questions of sustainability in higher education requires, therefore, the ability to deal with complex problems that are closely related to specific educational challenges. Solving problems in the context of sustainable development should not be oriented to simplistic mono-causal thinking, but instead should be about networked thinking (Siebert, 2003; Burandt, 2011).

ii) Problem orientation

Educational processes are triggered when students are faced with complex tasks, phenomena, or problems (from a sustainable-development perspective), set in a

realistic context. Traditional learning processes mostly focus on the transmission of abstract factual knowledge, which cannot be used for action in concrete situations. On the other hand, a problem-oriented approach is especially suited to supporting procedural knowledge and skills that are relevant to action (Garrison, 1997; Straka, 2000). Such learning is facilitated by complex, authentic problems involving different approaches and perspectives. One central principle of an education for sustainable development is participation in the processes of acquiring, generating, and applying knowledge (Rieckmann and Stoltenberg, 2011). This condition can best be met by working on projects (Stoltenberg and Burandt, 2014). The requirements of self-directed learning and collaboration described below can be seen as conditions for a problem oriented approach (Barth and Burandt, 2013).

iii) Integration of inter- and trans-disciplinarity

Adequate analyses and solutions within the field of sustainability cannot be supplied by a single discipline (Kaufmann-Hayoz, 1999; Defila and Di Giulio, 1998; Kruse-Graumann, 2005). For individuals to achieve a capacity to act, it is necessary to be able to link up systems knowledge – understood as knowledge about structures, functions, processes and interrelationships – with orientation or target knowledge, which takes the form of judgements, ethical orientation, thinking of alternatives, and, also, anticipative thinking (Fischer and Michelsen, 2000). If this is to be adequately integrated into higher education, it is necessary to develop interdisciplinary approaches that go beyond a mono-disciplinary orientation. This is not about creating a new discipline, much less a unified science. Instead, the goal is for universities to integrate different disciplinary knowledge bases with their specific approaches and methodologies in a common educational process. Such an integration of knowledge from different disciplines requires individuals and teams to engage in interdisciplinary thinking and working processes. Interdisciplinary collaboration opens up the possibility of a change in perspective for all those involved. It also provides scope, in contrast to an additive compilation of disciplinary knowledge, for developing new pathways to problem solving, while critically reflecting on the potential and range of disciplinary work.

Alongside the call for inter-disciplinarity, attention is now turning to an additional condition, namely that of trans-disciplinarity, which, by involving experts from different fields, including social practice, everyday knowledge, and other (often controversial) perspectives, allows the generation of new knowledge including meta-knowledge and key competencies (e.g. by understanding social structures, or gaining access to cultural diversity).

Solving complex social problems (see above) necessitates the integration of these two forms of knowledge. Higher education thus faces the challenge of advancing new ways of problem-solving at the interface of society and science on the one hand, and, on the other, of breaking down disciplinary particularities (Mittelstraß, 2003), thus enabling a problem-oriented understanding of the phenomena being studied.

Inter- and trans-disciplinary approaches to dealing with complex problems are bound up with wide-reaching methodological challenges. They involve a 'new culture of learning' that 'is empowering, autonomously organised, grounded and centred on competences' (Erpenbeck et al, 2003). For traditional teaching in higher education, this means rejecting the commonly practiced 'lecture-oriented teaching', and embracing an 'education of empowerment' (Arnold, 1993, p. 53), which supports processes of autonomous and proactive knowledge acquisition.

iv) Self-directed and collaborative learning

Education for a sustainable development does not follow any prescribed methodology. Instead, depending as it does on the context and subject, it can choose among different methodologies. However, participative and collaborative forms of problem-oriented learning have proven to be innovative educational concepts (Barth et al., 2007b; Burandt and Barth, 2010).

Self-directed learning approaches acknowledge that the learner plays the key role, because acquiring competencies requires autonomous and constructive learning processes, in which knowledge is developed actively and in a self-directed manner. The objective is to stimulate learning processes in which students

independently construct their own knowledge base (Inoue, 2009). This principle is based on a view of constructivist learning which is not directly linked to teaching. It emphasizes the active development of knowledge rather than its 'simple' transfer.

Furthermore, acquiring competencies is both an individual and a social activity. In contrast to co-operation, which focuses on allocating and sharing tasks, collaboration involves joint learning processes, with participation and social aspects as critical factors. Collaborative learning can appear in different types or forms, varying from collaboration among learners and teachers, to learning among learners only, to learning by learners with learning tools and materials (Norman, 2002). Successful collaboration increases both individual and collective knowledge, based on shared experiences and jointly accepted learning/collaboration objectives. Knowledge is produced as a result of shared group processes, during which different opinions and approaches are not only tolerated, but appreciated. Collaborative learning takes cognitive and social-affective aspects into account, and should integrate critical reflection (Dillenbourg, 2003).

v) Personality development

In addition to the acquisition of *Gestaltungskompetenz* (a holistic concept of the competences needed to help shape the future in a sustainable manner (de Haan, 2006)), the development of personality plays an important role, and not as an isolated characteristic but as an integrative trait (Michelsen and Märkt, 2006). Meeting the challenges facing society today requires individuals who are able to deal with complex situations, assess risks and the consequences of actions, and take decisions and act in a critical way. The development of such individuals is an 'ethical obligation for higher education'; and, therefore, one of its major responsibilities (Spoun and Wunderlich, 2005, p. 20). Higher education in the context of sustainable development thus faces the difficulty of evaluating knowledge from different disciplines, and arriving at an understanding of what this means for the individual and his or her responsibility to take action, thus making a contribution to the development of the individual's personality.

Implementation of higher education for sustainable development

Specific course modules on sustainability, or modules with the methodology of education for sustainable development, can, as a first step, be established within individual programmes of study. Still, there are also opportunities to change whole curricula, and even whole universities, so that they can meet the demands of an education for sustainable development. Sustainable development is understood in this context as a cross-cutting element, impacting all areas of university life.

The question now arises as to how the idea of sustainability can best be integrated in specific and concrete ways into teaching in higher education (Barth et al., 2007a). The simplest way is to include sustainable development (SD) content in conventional course modules already being offered. One common way is to hold a lecture series with experts from a variety of different disciplines, some of whom may be from outside the university. This enables a new topic to be approached more cautiously by bringing different disciplines together, each with its own perspectives, to focus on the common problem. While lecture series are a means of providing an initial engagement with a topic, a more comprehensive integration of sustainability into teaching requires creating new learning cultures. Starting from the constructivist premise that knowledge cannot simply be transferred, but is instead generated and constructed by means of personal experiences in concrete situations, means that the acquisition process is of central importance. Teachers must then create the conditions that enable learners to organize for themselves processes of autonomous learning. This also means that when aspects of sustainability are systematically integrated into existing course modules, teachers are open to experimenting with new forms of teaching and learning. Both of these two forms allow new SD contents and methods to be integrated and tested in a university environment.

But if *Gestaltungskompetenz* is to be a realistic educational objective then it is necessary to develop new forms of learning, in particular project learning in the form of 'learning through research', and

interdisciplinary offerings that accommodate not only contents that might not be immediately identifiable as belonging to a disciplinary canon, but also innovative teaching methods. These can take the form of 'add-ons', but they can also be designed for integration into a number of different programmes of study.

The highest degree of establishment is thus the integration of SD into existing curricula. There are three distinct levels (Thomas, 2004). Firstly, there is the integration of individual modules into the normal (required) curriculum. The second level is its integration into existing modules, which are expanded to include aspects of sustainability. For example, in modules involving project work, but also in interdisciplinary and practice-oriented modules, problems of sustainable development can be addressed and discussed. The third level is its comprehensive integration into the curriculum, with the concept of sustainability serving as a core value and framework for developing the contents of the whole curriculum.

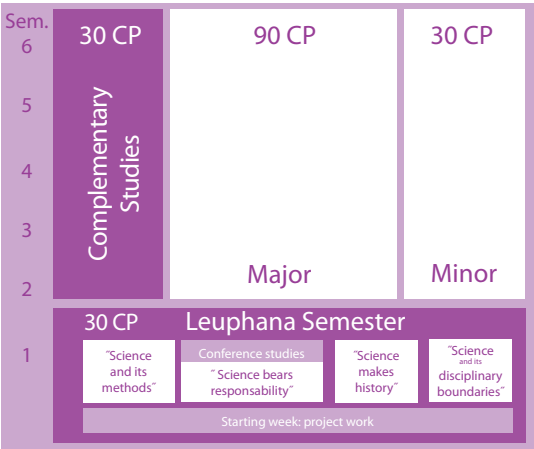
At the Leuphana University Lüneburg, after a long process of development, the academic model can now be considered to have reached the third level (Otte et al., 2014). In the following section, the university and its academic model will be introduced.

The full integration of sustainability in a curriculum: the Leuphana Bachelor's programme

Leuphana University Lüneburg has taken the opportunity provided by the Bologna Process to completely redesign its programmes of study. For all students enrolled at the university, the bachelor's programme now consists of major and minor fields of study with 90 and 30 credit points respectively. Various majors can be combined with almost all of the different minors. In the Leuphana Semester (see Figure 1), a common first semester (30 credit points) for all students has required coursework in mathematics and statistics, history, an introduction to a specific discipline, and the module 'Science bears responsibility'. This module accounts for one-third (10 credit points) of all credit points in the first semester, and focuses on aspects of sustainable development.

The Leuphana Semester aims to provide students with a broad education that is not obstructed by over specialization (Beck et al., 2012). Students come together in interdisciplinary learning communities. Over the course of their studies, they work to develop an inter- and trans-disciplinary discursive competence, firmly rooted in disciplinary competence. In order to cultivate this interdisciplinary shift in perspective, students take part in the Complementary Studies programme immediately after the Leuphana Semester. This offers interdisciplinary seminars from the second to the sixth semesters, many of which take up questions of sustainable development. Students have to take elective modules totalling 30 credit points in this programme (Barth et al., 2007b).

Figure 1 The Leuphana Bachelor's degree



Source: Authors

Leuphana University Lüneburg and the UNESCO Chair in HESD

Leuphana University Lüneburg (www.leuphana.de) considers itself a university for civil society in the 21st century, and bases its development on a comprehensive concept of education. It aligns its activities with a strong value orientation; its mission statement contains the key words: humanistic, sustainable and action-oriented. Leuphana understands education as combining the development of personality with professional training, embedding the learning process in real social contexts. Through research and education, Leuphana aims to make a contribution to the sustainable development of society by promoting competence in dealing with complexity, interdisciplinary problem- solving, and autonomous learning, together with the willingness and ability to take on social responsibility. Moreover, Leuphana considers itself a university that educates individuals who are willing to assume responsibility and take action, and who also have the imagination and critical intelligence, as well as the will and ability, to develop society creatively. Through its research, study programmes, and continuing education offerings, as well as through its service orientation, Leuphana feels it has a special responsibility to make a contribution to solving social problems.

Since 2005, the work of the UNESCO Chair in HESD has been focused on the questions of how the principle of sustainable development can become a guideline for higher education, and how it can be implemented into sustainability-related research activities. The UNESCO Chair is working intensively to implement these competencies in academic teaching and scientific research. Since its inauguration the Chair has been active in stimulating international debate about the meaning of sustainability as a paradigm for higher education institutions. Four international conferences have provided forums for the intensive discussion of a variety of topics, and, in particular, regional interpretations of sustainability needs. All four International conferences have served to initiate and broaden a global network of engaged higher education representatives.

At a regional level, the activities of the UNESCO Chair in Lüneburg have helped to realize aspects of sustainable development in different domains, and on different levels within the university. In teaching and learning, the focus is on fostering inter- and trans-disciplinary education and research in sustainability development, as a counter to traditional (and equally necessary) disciplinary approaches. These challenges have been largely achieved by the laying of two important cornerstones for the Leuphana Bachelor's Programme: First, in the so-called Leuphana Semester and, second, all students are able to choose a Minor in "Sustainability in Humanities". In the Graduate School, a Master's Programme in Sustainability Sciences was created in 2009. A distinctive characteristic of this programme in Sustainability Sciences is its dual emphasis on natural and human sciences, the Chair being one of the main contributors to the latter.

In 2012, a large-scale longitudinal study was started by the UNESCO Chair using a mixed- method approach to examine the impacts of the specific sustainability modules and the general Leuphana curriculum on its students' affective attributes (attitudes, values, planned behaviour, and interests) during their six semester degree programme. This study is one of the first to go beyond the evaluation of single courses and to also include comparison groups from other higher education institutions. Its goals are to evaluate how students learn and develop through the innovative Leuphana curriculum; and if students with different majors at the Leuphana University, or from different higher education institutions, have different learning outcomes, especially in terms of affective attributes in the context of sustainability competencies.

The UNESCO Chair has developed a certificate program qualifying journalists in the field of sustainable development and sustainability communication. In 2013, the second cohort of journalists from a variety of different fields of specialization in Germany started this programme of study. In addition, the German Environmental Foundation funds a project coordinated by the Chair aiming at improving quality in SD journalism through workshops and network building among actors in this field. The main focus of this programme is helping journalists to improve their knowledge and ability to deal with complex issues of sustainability.

On the national level, the UNESCO Chair influences policy on higher education for sustainable development. As a member of the German working group on higher education of the UN Decade Education for Sustainable Development (ESD), the Chair continues to advance sustainability as a new paradigm for higher education in Germany. In 2011, the Chair contributed to the working group's conference 'Universities for Sustainable Development: Vision 2030'. Furthermore, Gerd Michelsen serves as Member of the Board of the German National Commission for UNESCO, and is Chairman of the Committee on Science.

The module 'Science bears responsibility' offers students, whatever academic specialization they may later choose, the opportunity, in their first semester, to explore an interdisciplinary topic.¹ This approach involves using the normative concept of sustainable development to investigate fundamental issues related to the responsibility of science in society. In inter- and trans-disciplinary project seminars, students independently analyze research questions, and then present their findings during the Conference Week (see Conference Studies in Figure 1). This module gives students an interdisciplinary introduction to science, and to formats for confronting issues in sustainable development.

The module emphasizes that responsibility and sustainability, as part of a concept of justice, are interlinked. With the sustainability principle as the normative anchor of a concept of responsibility, students are able to analyze and propose solutions to conflicts about sustainability. Students focus on the

question of who can work, and in what ways, towards sustainable development and towards just institutions.

A series of lectures, and accompanying tutorials, define the framework of the module. They introduce students to the complexity of sustainable development, and provide them with a preliminary set of tools so that they can orient themselves in subsequent trans-disciplinary debates about sustainability. In their lectures, students encounter teachers who work with them to expand their perspectives, by introducing them to different academic disciplines, as well as to issues of practice in civil society.

An important area for cooperation among students and teachers in this module is that of the project seminars. In roughly 60 project seminars, each with a maximum of 25 participants, students are able to gain an in-depth look at a single topic in sustainable development. They explore this topic for the first time as researchers in small-scale projects, testing their own hypotheses and finding results. They then present these results to the general public at the end of the semester. The Conference Week is the conclusion to the Leuphana Semester. It is also a place for students to enter into discussions with visiting guests from the worlds of

¹ Majors are offered e.g. in the economic and social sciences, education sciences, cultural sciences, environmental and sustainability sciences, digital media, law, business information systems and engineering sciences.

politics, science and civil society about the opportunities and limits of shaping the future.

Two core didactic elements are crucial to the 'Science bears responsibility' module: (1) the analogy to the academic research process and (2) the project nature of the seminars. The teaching/learning format of the module relates to the three phases of the research process. While the seminar series and tutorials represent the traditional form of knowledge acquisition, the project seminars are closer to the actual way knowledge is generated in science. Moreover, the Conference Week is similar to the communicative phase of the research process where findings are published, with students presenting their own results from their work during the semester, which are then critically discussed by the general public.

When students learn while doing their own research project in the seminar, they become familiar with the perspectives, attitudes and approaches of researchers (Defila and di Giulio, 1998; Kaufmann-Hayoz, 1999). The seminars achieve their project-oriented profile through the high degree of autonomous group work, which is embedded in a real-problem context associated with the challenges of sustainable development (Scholz and Tiedje, 2002). The project report contains two crucial phases of work: (1) the planning of the research project, from identifying a specific research question, to the research design, to creating a work schedule; and (2) the implementation of the project, together with the presentation of the results and then some critical reflection on the research results. In the Conference Week, the students learn more about a common format of critical reflection in science. At the same time, its emphasis on the production of knowledge is a potential source of future motivation for the student. Finally, the conference offers the opportunity to organize the assessment of student work in quasi-realistic contexts. Without doubt, the core didactic elements of the module change the role of the teachers. During this module, a more traditional teacher will ideally become a facilitator of successful, autonomous learning processes.

Some examples of module titles in the seminar programme

- Biodiversity and Ecosystem Functions in Public Awareness
- CSR: Charming, Sexy, Revolutionary – On the Track of Suspicious Cases of Corporate Social Responsibility
- The Dream of a Life: Migration from Africa to Germany
- A Culture and its Relationship with Things – Luxury or Necessity
- Environmental Justice and Sustainability
- Hunger for the 'Good' Life – Food Sovereignty in the 21st Century
- Art and Sustainability: The Example of the Lagoon Cycle of Helen and Newton Harrison
- My House, my Garden, my Pool? How Can We Live Sustainably in the 21st Century?
- What Makes Life Good? Citizens and Students on the Track of an Idea

Conclusions

The integration of sustainability in university teaching is about more than simply introducing new topics to the syllabus. Both teachers and students are called on to become involved in new material and methods. At the same time, integration can take place on a number of different levels. The Leuphana Semester at Leuphana University Lüneburg, together with the 'Science bears responsibility' module, demonstrate how innovative methods of teaching and learning can be combined with the topic of sustainable development, and how new forms of university teaching can be introduced (Schneidewind and Singer-Brodowski, 2013). This is even more the case when the whole university is moving towards sustainability, and has dedicated itself to the whole-institution approach. The university itself is becoming a learning space in which a variety of informal learning processes take place.

Against a background of the Bologna Process, and the 2005 Bergen Declaration (Bergen Communiqué, 2005), which together set the goal of making aspects of sustainability an integral part of all Bachelor's and Master's programmes, the Lüneburg approach provides a reference point for other universities. It implements the competency approach in the Bologna Process, and shows how complex problems can be worked on in an inter- and trans-disciplinary manner. Moreover, in addition to teaching competencies that improve employability, the module makes a contribution to students' personal development by encouraging them to take on responsibility, articulate ethical standards, deal with complexity, develop their own opinions, and exercise judgement (Michelsen and Märkt, 2006; Spoun and Wunderlich, 2005). This approach is not based on simply teaching subject matter, but on enabling students to analyze various problem areas from different perspectives and then, together with others, to deliver a contribution to solving real problems – while always accounting for justice and responsibility.

With regard to module content, it becomes apparent that, due to the complexity of the field of sustainability,

a single discipline alone is unable to provide adequate analyses and solutions. If teaching in higher education is to deal with this complexity successfully, then it is necessary to develop inter- and trans-disciplinary approaches that go beyond a purely specialist orientation. Furthermore, if problem-solving approaches are to succeed in achieving their objectives, then it is also necessary to work on the solution within the implementation context, and in close interaction with societal practitioners (Michelsen, 2012; Thomas, 2004).

The challenge for teaching in higher education consists of helping students learn about the ambiguities of complex systems. In the context of sustainability, learning should be organized as an open-ended process of searching and understanding that requires critical group reflection. This can be achieved by creating spaces for collaborative learning processes (Michelsen and Adomßent, 2012). The incorporation of aspects of sustainability into university teaching offers the opportunity to meet the demand for general and work-relevant social and personal competencies through methodical and practical approaches to learning, while training students in critical thinking and other essential skills.

A variety of innovative approaches to teaching in the context of sustainability is being developed worldwide. Each of these approaches has its own particular experiences and findings. It is crucial to initiate international exchange in order to intensify network-building. The aim would be to share best practice with each other so that each institution can further develop its own approaches.

The UNESCO Chair in Higher Education for Sustainable Development is contributing on a local, national and international level to research, development, teaching, exchange, and to knowledge transfer on and of education for sustainable development.

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International E-learning Programmes for Sustainable Development in Higher Education in Europe and Africa

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**UNESCO Chair on Knowledge Transfer for Sustainable Development Supported by ICTs
The Open University of the Netherlands**

Higher education programmes in the field of sustainable development are often perceived as complex and contradictory by students. This paper describes two types of solutions in university (college) programmes, in the Global North and in the Global South. A greater and more diverse number of students and people can be reached using e-learning modalities and open-educational resources.

A consortium of seven European universities has developed an open-access Master's level track, called 'Lived Experience of Climate Change', in which academic knowledge is linked with the lived experiences of individuals. With the concept of lived experience, distant scientific knowledge is connected with personal, local and cultural experiences, and diversity is used as a source of social learning and holistic knowledge. This diversity is the starting point for intervention competence, in which knowledge is translated into actions or decisions. With intervention competence, students learn to formulate and implement actions to address sustainability issues, mindful of the diversity of societal aspects both globally and locally. In this way, students learn about, and learn to use, perceived complexity and diversity as a resource, instead of as a problem.

One curriculum development project, in collaboration with a university college in Kenya, focuses on sustainable entrepreneurship. The approach is to reach out to students who require part-time higher-education solutions closely connected to what they do in life. The programme targets job creation and social impact for local communities, without disregarding environmental aspects. Established gaming principles are used, and are connected to the writing of a personal business plan. Learning materials are produced, and then re-used as open-educational resources.

Introduction

The UN Decade of Education for Sustainable Development (DESD)

Climate change, the exhaustion of conventional energy supplies, water pollution, the loss of biodiversity, and air and soil pollution, are some of the sustainability issues that humanity is facing today. These issues are recognized as constituting considerable challenges and risks for our future. 'Sustainable development' was notably defined, over a quarter of a century ago, in the report of the World Commission for Environment and Development, as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (Brundtland, 1987). The former Norwegian Prime Minister, Gro Harlem Brundtland, chaired that commission.

Since then, many attempts have been made, and at several levels, to make the concept adequately operational. In the educational field, the United Nations (UN, 2002) declared the Decade of Education for Sustainable Development (2005-2014), promoting education in this field around our globe.

Now that we have reached the end of the UN Decade, it is useful to ask ourselves what has been achieved, what we have learned, and how we would like to proceed. Over the past decade, many scientists and educators have developed and evaluated academic programmes for higher education in this new field of sustainable development. Much progress has been made, and innovative forms of education have emerged (Corcoran and Wals, 2004; Wiek et al., 2011). Key aspects of this newly developed field of education include multi-disciplinarity, integration of knowledge and skills (competencies), critical thinking, understanding complex systems, using multiple future scenarios, and participatory teaching and learning methods.

However, the learning and teaching in this field is still perceived by students as complex and contradictory (see, for example, Leal Filho, 2010; Wiek et al., 2011), and it leaves them with uncertainties about their future professional practice. These uncertainties concern at least two big aspects. On the one hand, there is the contradictory interpretation of findings from the natural sciences. How serious, for example, is climate change?

What is the scope and validity of scientific models of climate change? What experimental data would change theoretical interpretations and, as a result, the models themselves? Scientists seem to differ considerably in their appreciation of the problems and their urgency.

A second problem that students report is that they are having difficulty translating global sustainability issues into their immediate surroundings and lives, both in terms of their relevance, and in terms of the appropriate actions to take. Academic programmes often tend to focus on scientific analysis, while somewhat disregarding the 'change' and 'development' aspects in sustainability issues. In fact, it is crucial to ask what types of generic academic knowledge there are about action and processes, and which competences students can develop during their academic career.

In the Netherlands, the UNESCO Chair on Knowledge Transfer for Sustainable Development supported by Information and Computer Technologies (ICTs) is addressing these problems by developing an appropriate conceptual framework, in which diversity is considered as a creative force for knowledge-construction, and in which competences for intervention and action are part of the educational programme (see Box 1).

Box 1. Educational and research activities of the UNESCO Chair

The UNESCO Chair on Knowledge Transfer for Sustainable Development supported by ICTs at the Open University of the Netherlands is a focal point for scientific investigations and collaboration in the field of education and learning for sustainable development and (environmental) science. The chair is positioned in the Faculty of Management, Science and Technology.

As a primary research area, competence-based academic curricula in environmental sciences are being developed and investigated with specific attention to 'intervention competence'. With intervention competence, students learn to formulate and design socially robust solutions for issues in sustainable development.

A second research strand of the Chair is the development of attractive and practical knowledge concepts for sustainable development. One of them is the knowledge concept of lived experience. It assumes that a person's experiences, as they have evolved over a lifetime, influence their attitudes towards sustainable challenges. More enduring aspects, such as culture, gender, social class and ethnic group, are part of these experiences. One of the hypotheses is that connecting to these specific lived experiences of individuals will lead to more involvement and to better (accepted) change processes. Very often, government policies do not keep this in mind, because diversity is perceived as a 'problem', instead of as a source of innovative power.

A third strand in our research is the development, and investigation, of modern ICT tools and open education concepts, and how they can assist learning processes. This research is explored in the fields of climate change and social entrepreneurship, but it can also be extended to other fields. There are approximately two full-time equivalent staff available to support the Chair in these activities.

This research is performed with partners in the Global North and the Global South. These are scientists and educators from European universities and an African university college. Additionally, the Chair cooperates with several societal organizations, such as the Dutch Association of Environmental Professionals (Vereniging van Milieuprofessionals) and Africa in Motion, a network set up by African migrants in the Netherlands.

ICTs and e-learning

The emergence of the internet and its global use has greatly increased the possibilities for developing and disseminating educational programmes. Since one of the main objectives of ESD is to spread this vision throughout the world, it seems logical and appropriate to connect e-learning with ESD. In addition, it fits well with the vigorous interest in open education (UNESCO, 2012). An environmentally friendly side effect is that the use of ICTs reduces the carbon footprint, whilst allowing interaction on a global level, since face-to-face courses can be substituted by using virtual mobility in their design (Pérez-Salgado, 2008).

The research ideas mentioned above have been implemented in two projects. The first concerns a collaborative project undertaken by seven European universities in an Erasmus European Union Programme (Wilson, et al., 2011). An innovative e-learning Master's level track called 'The Lived Experience of Climate Change' was developed, introducing new concepts concerning both the knowledge, and the skills, that are necessary for sustainable development. In the second project, a two-year Diploma Programme in Social Entrepreneurship at Tangaza University College (Nairobi, Kenya) is being developed, with e-learning expertise from the Chair's programme.

The chapter will proceed as follows: Section two will explain the concepts of lived experience and intervention competence in relation to sustainable development. This is exemplified by the Master's track 'The Lived Experience of Climate Change', which is available as an open-educational resource. Then, Section three will illustrate the design and development of the diploma programme 'Social Entrepreneurship' in Nairobi (Africa), and will report on its interim evaluation results. Finally, in Section four, conclusions will be presented in relation to the UN Global Action Programme on ESD (UNESCO, 2013). The results presented range from conceptual innovation to educational practice in sustainable development, and they provide e-learning educational materials that are available to people around the world.

Concepts for sustainable development: Lived experience and intervention competence, exemplified in an e-learning Master's track

Social learning and power relations in science and society

Sustainable development is linked to a process of global social change. One could say that a conceptual shift has taken place over the past years from sustainable development as an end point for society (scientifically defined once all the relevant data are known), to a process of social learning and action (where multiple, evolving, in-between 'points', at different moments and in different places, can be found). A cycle of learning could be envisaged in which different perspectives are brought together, debated in an open dialogue applying or creating new knowledge in the process, and then followed when action is taken and the desired intervention is implemented. To close the circle, these actions are evaluated, and then the cycle starts again.

This description is based on the theory of social learning and action, which Kolb (1984) has depicted as a cyclical relationship between learning and action, including evaluation and planning. An important amendment to the theory was later made (Bandura, 1997), namely that in the case of low levels of participant self-efficacy, learning might not take place at all, or might even be avoided.

In this cyclical, or better, this 'spiral' process, problems not only arise on the social learning side but also in social reality. In social reality, power-relations influence decision making, and different perspectives do not, in practice, have equal validity. In a constructivist analysis (Foucault, 1980; Haraway, 1988; 1989), new knowledge that is emerging reflects the interests of the most powerful. The production of scientific knowledge is influenced by social and cultural aspects (social status, ethnic group, gender, cultural identity, etc.). Science for sustainability, when developed within university institutions, is subject to these forces as well (Pielke, 2007; 2010), and will therefore reflect (consciously or unconsciously) the choices, opinions, imagery and language of the most powerful. In a constructivist analysis, striving for 'objective' knowledge

is critically questioned, and it is argued that scientific processes are better described in terms of conflicting, and sometimes opposing, knowledge claims. These knowledge claims and power relations play out at several levels, at an individual (gender, ethnic group, social class), institutional (prestige of university), national (wealth and influence of nation), and international level. The different perspectives on several issues of sustainable development from the Global South and North could also be analyzed in this way. As a result, not only is the resulting science contested, but its economic and social implications are even more so.

In addition, the inherent complexity of this type of science (multiple variables, several levels of interaction, a multitude of scenarios) introduces elements of uncertainty to predictions, which makes this science 'fallible' for students, and for the general public.

Educational approach and programme development

These uncertainties and opposing scientific interpretations create confusion for many students when embarking on a course related to sustainable development. The question arises as to what should be taught, and what the overarching principles of such a course should be. In answer to this question, over the course of the Decade for ESD, a consensus has grown that education for sustainable development should include the following aspects in its programmes (UNESCO, 2004; 2010):

- Awareness-raising of the different levels of, and perspectives on, human-induced environmental problems and challenges (different temporal and spatial scales; economic, political, societal and cultural diversity).
- Interdisciplinary approach.

Fitting in with these aspects, but also extending them, is the concept of lived experience. With this concept, one can teach students the simultaneous validity of multiple perspectives. More importantly, perhaps, one can use the concept to explain why these multiple perspectives exist, not only among the academic disciplines, but also in relation to the general public.

The people-centred concept of lived experience in sustainable development

Wilson et al. (2011) introduced the people-centred concept of lived experience in an e-learning Master's degree programme developed by an interdisciplinary team of natural and social scientists and engineers in a European Union Erasmus project.¹ The Master's track consists of four modules (a total of 325 hours of study), and was developed using a competence-based approach.

'Lived experience' is knowledge gained by people over time, through engagement with each other and by learning from actions. It is thus an evolving type of knowledge possessed by an individual, but it is also influenced by more enduring factors such as social class, gender, ethnic group, and local cultural values. It has explanatory power in itself, because it describes why and how people, even when living next door to each other, interpret the same global challenges differently, depending on their specific situation and experiences. It explains the variety of simultaneous, co-existing, and often contradictory perspectives on these challenges. It relates the social conditions of humans and human actions to knowledge production. In fact, it reclaims everyday experiential knowledge as an important factor in interpreting global challenges, emphasizing that science produced in academic institutions is not the only 'truth' able to inform these challenges. Finally, the use of this concept also potentially solves the so-called scientist-citizen dichotomy, since scientists are also human beings with lived experiences.

Intervention competence for sustainable development, using e-learning

To didactically implement the concept of lived experience, a competence-based approach was used (Pérez Salgado et al., 2012), incorporating the multidisciplinary and integrative aspects of sustainable

development. With e-learning, quality education can be provided for many people across geographical boundaries, thus ensuring a rich diversity of perspectives. The following definition of competence is used:

Competence is defined as a cluster of knowledge, skills and attitudes, which can be acquired and learned through tasks performed in the workplace or through simulations of authentic work environments.

As for identifying and labelling adequate competencies for sustainable development, a great variety have been reported in the literature during the UN Decade (see for example Corcoran and Wals, 2004; Runhaar et al., 2005; Barth et al., 2007; Wiek et al., 2011). Researchers then attempted to identify certain key, or core, competencies. In a broad review of the literature, Wiek et al. (2011) show a great variety in the key competencies reported in university programmes, often with blurred and vague categories as to what sustainability professionals should be equipped with. In an attempt to bring together the various competencies, they introduce a reference framework with five competencies: system thinking competence, strategic competence, normative competence, anticipatory competence, and inter-personal competence. They identify an intervention point in their reference framework where these competencies come together, but they do not attach a competence to this point. For an overview of the many competencies for professionals in the field of sustainability, see, for example Willard et al. (2010). In targeting social environmental sciences, Runhaar et al. (2005) describe policy competencies that focus on the ability to organize interactive policy-making processes with regard to environmental issues. Summarizing and analyzing this literature on competencies, one might say that the action part is somewhat disregarded or overlooked.

Specifically, for the action part of the sustainable development process, Pérez Salgado et al. (2012) introduce a key competence they call 'intervention competence'. Intervention competence starts off with a combination of scientific and experiential knowledge in order to create an integrated assessment of sustainable

¹ See <http://www.ou.nl/eCache/DEF/2/46/335.html> (in English and Dutch), <http://www.leche.open.ac.uk> (in English); <http://www.openuped.eu/courses/details/1/10> (in Portuguese, and as a MOOC, or Massive Open Online Course retrieved August 11, 2015

development issues. It is based on insights into natural sciences (geography, biology, chemistry and physics), but also requires scientific knowledge of the social, economic, political, gender, and cultural dimensions. In an open dialogue, and in direct engagement with the actual lived experiences of the participating stakeholders, decisions and actions are then developed. With this competence, students learn to take, and indeed do take, the step from studying a problem, to formulating ways of, and options for, achieving it. They then take the further step towards determining upon decisions, or interventions, and then effectively working on the processes of change themselves. Thus, this approach serves social and societal change. A comprehensive definition of intervention competence for sustainable development would be: 'The ability to devise or propose, independently and in a process of consultation with relevant actors and stakeholders, one or several sustainable solutions to an issue of sustainability'.

Mogensen and Schnack (2010), and, in earlier work, Jensen and Schnack (1997), have described an 'action competence approach' in environmental education. They argued that this approach complements existing curricula, which are primarily concerned with scientific knowledge in environmental sciences. Somehow, this action competence approach has gone unnoticed in the international academic discourse on key competences for sustainability, since Barth et al., and Wiek et al., do not mention it. Intervention competence, as introduced by Pérez Salgado et al., bears a resemblance to the action competence approach. However, action can apply both to habitual action (what one has always done, on a routine basis), as well as to newly designed action. Only as a result of deliberate and conscious mental processes will an individual change his or her habits, and thus intervene in them. By choosing the word 'intervention', an emphasis is put on newly designed and different actions, which are thought to be necessary for sustainable solutions.

Intervention competence involves the following dimensions (Pérez Salgado, et al., 2014):

- Having confidence in one's own scientific knowledge, and being able to learn from lived experience.

- Being aware of the variety of solutions related to different perspectives and to different groups of actors and stakeholders.
- Appreciating the importance of reaching decisions or interventions.
- Showing a specific disposition, namely the wish for goal-oriented, adequate action in a complex context.
- Adopting ethical practices.
- Being able to translate diversity into (designs, propositions and decisions for) interventions

It is clear that problems can arise in any of these dimensions, and that change processes will not be easy to conduct successfully. From an educational point of view, the following questions arise: How can each of these dimensions be put into practice in an academic programme? How can students effectively learn these aspects of intervention? What are the reliable, valid and cost-effective ways of assessing them?

To further investigate this competence, the authors recently conducted research using an action-participatory approach with groups of environmental professionals. In this way, detailed information was gained on the features constituting intervention competence and its dynamics.

By designing competence tasks for students in an e-learning environment in such a way that they can practice intervention competence at each level, students could gain insights and mastery in a step-by-step fashion. When students master intervention competence, they are prepared for their future roles as professionals in the field and as active citizens. In fact, intervention competence can be seen, on the one hand, as the lynchpin between science and scientific knowledge in higher education and on the other hand, it can be seen as processes of change in society and in personal actions.

The design and development of the diploma programme on social entrepreneurship

The diploma programme on Social Entrepreneurship is a collaboration between the UNESCO Chair and the Institute of Social Ministry in Mission (ISMM) at Tangaza University College (Nairobi, Kenya).² Its goal is to develop a two-year academic e-learning based diploma programme. In this section, the design and development process are presented.

ISMM offers programmes for change agents in the local community (Pierli, 2010). The programmes teach students to work towards a future-oriented transformation of the local community with the aim of bringing about prosperity, peace and equal rights for its members. In its teaching, the concepts of 'people, profit and planet' are integrated, which means that regional development is addressed in a sustainable way. ISMM is a partner on the local level, meeting local needs and solving local problems, and developing its own content. The ISMM's programmes are in demand with groups of students that do not have the time, or the economic means, to join the campus-based full-time programmes. For this growing group of students, the Institute is developing a part-time e-learning solution and is partnering with the Open University of the Netherlands for e-learning expertise.

Entrepreneurship within a social and sustainable context is an instrument for fighting poverty. The target group for this programme is the large number of entrepreneurs in start-up companies known locally as *Jua Kali* (King, 1996). In terms of the Global Action Programme on ESD (UNESCO, 2013), this project targets the priority action areas of educators, youth, and local communities.

Conceptual framework for curriculum development

The conceptual framework is defined by the mission of the Institute that targets adult learners (Commonwealth of Learning, 2009; Parise, 2012). The approach is a careful

mix between accepted approaches to module design and material development. Contracted developers are proficient in the development of courses and modules, using the template and guidelines of the Commonwealth of Learning (COL, 2009) on e-learning modules for adult learners. In the implementation, the Four-Component Instructional Design Model (Hoogveld, 2003, Van Merriënboer, 1997) is used to fine-tune the connection between theoretical modules and student activities. It is through the characteristics of e-learning (ICT and multimedia options) that this framework is implemented.

When developing materials, open educational resources (OER) (Butcher, Kanwar and Uvalić-Trumbić, 2011; D'Antoni and Savage, 2009) are used wherever possible. Delivery is based on a dedicated e-learning software programme, called EMERGO³, for teaching complex skills (Hummel et al., 2011; Nadolski and Tattersall, 2006). Research is being conducted into the level of acceptance of this approach among stakeholders. Staff, students and alumni were offered a workshop on e-learning issues, including design and development, to match their learning needs. After the workshop, the students filled in a survey on the design of the programme. In total, five ISMM staff members, and two ISMM alumni, were interviewed, and 16 ISMM students in other programmes completed the questionnaire.

Curriculum design and development

The curriculum design process resulted in a design featuring both theoretical modules and an integrative module on writing a personal business plan. The theoretical modules were designed according to the COL template (COL, 2009), and were grouped in five distance learning sessions, each of which containing four modules. Between each block of four modules, face-to-face meetings were programmed, in order to provide scope for support activities and interim assessment. In the business plan module, students work on their own business plan throughout the programme. For certification, the theoretical modules, as well as the business plan, need to be completed and assessed.

² <http://www.tangaza.org/ismm/>

³ For information on EMERGO, see: <http://emergo.cc>

The evaluation (interviews as well as feedback from the questionnaires) shows strong support for the choices made regarding the move to competence-based and student-centred learning. The experience of alumni and staff is that students need practical skills to apply their theoretical knowledge when working in the communities. Targeting competence development, and putting the student and his or her study activities at the centre of the learning process, provides a better starting position for the students after graduation. The use of OER, especially video materials, was welcomed. The videos show complex situations, as can be found in the community development projects.

Changes in the student population have meant that the Institute must adapt its teaching. Diversity in student background and prior knowledge require a more flexible approach facilitated by ICT. A growing number of students seek access to study programmes through e-learning. To serve these students, a decentralized approach is being developed with partners in different regions. In terms of student support, both local support and ICT-based support are needed. The authenticity of materials, especially those achieved with video, is an important factor in preparing students for their future professional careers.

However, there were also criticisms. These mainly concerned the need for a proper introduction to these new ways of teaching. In particular, both staff training, and support for students in the use of the technology, were considered important. The most striking results of the survey were the large support for open and distance learning (ODL), as well as for the part-time option through e-learning. This can be explained by the flexibility in time and location that allows students to study and work at the same time and avoid travel time and costs.

In summary, e-learning can be seen as an instrument to bridge a number of major problems in education in Africa. These are a lack of human resources to teach, a lack of infrastructure to provide study places, and a lack of good quality learning materials. At the same time, Africa faces the problem of being dependent on external donor-driven education that is not locally produced, and is not targeting local problems. Recent research by eLearning Africa (Isaacs and Hollow, 2012; Isaacs, 2013)

shows the increase in the use of e-learning solutions and the number of students involved for the whole of Africa. Initiatives like eLearning Africa, OER Africa, and the African Virtual University, create a new podium for ESD. This is especially the case in higher education with a special emphasis on teacher training (Aderinoye and Ojokheta, 2004; Butcher, et al., 2011b). The design of the programme presented in this chapter reflects the notion of ESD as encountered in most ESD programmes in higher education (Rikers, et al., 2012), where more and more ESD programmes show an integrated approach involving different domains. But it also reflects the notion on ESD as reflected by one of the initiators of the DESD, Hans van Ginkel, a former rector of the United Nations University. Van Ginkel stresses that, 'ESD fosters sustainable economic growth by improving the quality and skills of the workforce' (Van Ginkel, 2011, p. 35).

From the collected data, it can be concluded that the choices made regarding the development of the diploma programme are strongly supported by the stakeholders. This provides encouragement for ISMM at Tangaza University College to proceed with curriculum development.

Conclusions

In the past decade, much progress has been made in developing appropriate concepts and educational methods for teaching and learning in the field of sustainable development. However, students remain confused due to some uncertainties that have continued to accompany different courses on sustainable development. Two e-learning higher education programmes in Europe and Sub-Saharan Africa, which offer solutions to these problems, are presented in this chapter. These programmes are part of the Netherlands' UNESCO Chair on Knowledge Transfer for Sustainable Development supported by ITCs. The Master's level track called 'The Lived Experience of Climate Change' is a 325-hour programme developed by scientists and educators from seven European universities, in which multidisciplinary scientific knowledge is related to 'lived experience', and study tasks are designed using a competence-based approach. In Kenya, a two-year ODL (open and distance learning) Diploma Programme on Social

Entrepreneurship is being developed by local educators based on the needs of nearby local communities. Both are certified programmes, but the contents are also available as open-educational resources, and therefore accessible to educators, scientists and people all over the world.

Diversity, action and intervention

The people-centred concept of lived experience, introduced by Wilson et al. (2011), has explanatory power in that it describes how a great variety of different and opposing views on sustainability issues can co-exist at the same place and time. It examines an individual's experience acquired over the course of a lifetime, while taking into account more enduring group factors such as gender, social class, ethnic group, religion and culture. By connecting these lived experiences to institutionalized scientific knowledge, diversity is an inevitable outcome. Instead of labelling this as a problem, it can also be seen as a creative source for change and innovation.

To describe the ability to take adequate action for sustainable development, Pérez Salgado et al. (2012) introduce intervention competence. Intervention competence consists of several dimensions, each of which can be trained and learned. It starts off with an awareness of the great variety of different solutions related to different perspectives, and to different groups of actors and stakeholders. Secondly, it involves practice of the complex communication process that takes place between professionals and the people they are working with, trying to reach agreement in an open dialogue. Thirdly, one needs to appreciate the importance of

reaching decisions or interventions by showing a specific disposition, namely the wish for goal-oriented, adequate action in a complex context. Finally, one must be able to translate this diversity into decisions for interventions, and be able to adequately guide the implementation.

In the sub-Saharan African context, poverty eradication and sustainable community development are key elements for ESD (Takang and Bukania, 2014). The entrepreneurship educational project provides a way to include local experience in the learning process. The lived experience concept allows for diversity in settings where knowledge from all stakeholders contributes to local solutions. At the same time, ISSM at Tangaza University College is focusing on educating agents of change to encourage social transformation. The action-based approach in the curriculum ensures that transformation is actually taking place to the benefit of the local community.

As described in this chapter, both the concepts of lived experience and intervention competence contribute to the DESD goals. At the same time, the educational programmes discussed confirm the approach as stated in the post-2015 Global Action Programme on ESD. The focus is on educators, youth, and local communities, and on using new instruments and technologies. The projects also address new developments that are considered relevant to an effective spreading of ESD, namely open education and the use of open educational resources.

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From Theory to Practice: Challenges and Constraints to Introducing Education for Sustainable Development in Uzbekistan

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Abstract

The expansion of irrigated agriculture throughout Central Asia has had far-reaching consequences for the landscape, ecology, and people in this region. Unsustainable agricultural practices have contributed to livelihood insecurity and environmental instability. A comprehensive strategy for sustainable development needs to be based on both sound, long-term development plans, and on the human and institutional capacities that are necessary to develop and implement these plans. Although the role of education in sustainable development has been widely recognized, these links were ignored in Uzbekistan, Central Asia, during seventy years of Soviet rule. Following independence in 1991, Uzbekistan was challenged to bridge this gap, and nowadays education is declared to be an indispensable means for achieving sustainable development. Still, countrywide curriculum development, and the elaboration of suitable learning environments at higher educational institutions, have not yet matched official declarations. These goals have become key challenges to the UNESCO Chair of Education for Sustainable Development (ESD), which was established in 2011 at the State University of Urgench, with support from the Center for Development Research (ZEF) at Bonn University in Germany. The short-term vision of the ESD Chair is to establish a foundation for enhancing the educational and research skills of the next generation of lecturers, by

exposing them to concepts of sustainable development, underlining the links between ecology, livelihoods and well-being, and encouraging them to develop networks among educational institutions.

The whole experience has pointed to a number of structural, didactic, and pedagogical preconditions for promoting ESD in higher education in Uzbekistan. These include, first of all, a series of preparations to be completed before setting up an ESD chair. In addition, lessons learned point to the need for a number of preconditions. The first of these is sustainable and full access to educational resources at all levels of education. The second is the availability of information technologies to ensure both the quality of education and training, and an effective management of the university administration. The third precondition is a stimulating learning and teaching environment for lecturers. This includes involving them in curriculum development, and allowing them adequate time to dedicate to tasks (e.g. reducing routine tasks, automating standard documentation and reporting, etc.). It also includes the permanent monitoring and analysis of the teaching process, and efforts to boost student awareness of the future role of science technology development and education for sustainable development. The fifth precondition is a transparent and open system of assessing students and lecturers, including a clear definition of rating and progress.

Finally, a sixth factor is the improvement and self-enrichment of pupils through the use of a variety of teaching procedures, including distance learning. The aim is to produce motivated students, well prepared for lifelong learning and independent education. When implemented, these six lessons are likely to lead to an educational system with well trained and skilled human resources, and a conducive learning environment, in which sustainability is soundly embedded. This will promote the overall quality of education. Furthermore, it will enhance the science capacities of the universities and lead to efficient learning in higher education that represents good value for money.

Introduction

The concept of 'sustainability', strongly advocated since the 1980s, emerged principally to protect ecological processes and biodiversity through a sustainable use of natural resources. At the same time, it was intended to support developing countries in combatting poverty, as rural communities were over-exploiting limited natural resources. This overarching strategy of sustainable development rapidly became part of national and international policies, programmes and concepts concerned with the environment and development. This included education, a domain in which sustainability has gained momentum, especially since the 1990s. For instance, the World Conservation Union (IUCN) refers to 'education for sustainable living'. Meanwhile, others refer to 'education for sustainability' (e.g. National Forum on Partnerships Supporting Education about the Environment, USA 1996). In 1996 UNESCO-UNEP began using the terms 'education for sustainable development', and 'education for a sustainable future' (UNESCO-EPD, 1997). Since then, much debate has surrounded the question of how to better define the relationship between education and sustainable development. This has included discussion of how this may differ from conventional approaches to environmental education (see, for example, Sterling, 1992; Fien, 1995; 1997). In 1992, the British Environment and Development Education and Training Group (EDET) defined the nature of education for sustainability. 'We believe that education for sustainability is a process which is relevant to all people', it declared, adding, 'like sustainable development itself, it is a process rather than a fixed goal'. This process, 'may precede – and it will always

accompany – the building of relationships between individuals, groups and their environment', the EDET group said, concluding that: 'All people, we believe, are capable of being educators and learners in pursuit of sustainability' (Sterling 1992, p. 2). Irrespective of the wordings, there is now a consensus that education is an essential means of achieving sustainability, and that sustainable development, and education and training, have gained public recognition as having a key role to play in moving society toward sustainability. From 2005, UNESCO was the lead agency for the UN Decade (2005-2014) of Education for Sustainable Development (ESD). This UN Decade aimed to allow every human being to acquire the knowledge, skills, attitudes and values necessary to shape a sustainable future. UNESCO foresaw that ESD would serve 'the promotion of competencies such as critical thinking, imagining future scenarios and making decisions in a collaborative way'.

Following independence from the Soviet Union in 1991, the education system in Uzbekistan needed to be regulated anew, a process which was completed in 1997, through the Education Act and the National Program for Personnel Training. This has laid the legal, scientific, methodological and financial basis for a stepwise reform of the national education system. The State Committee for Nature Protection, as well as the ministries of public education and of higher and secondary specialized education, have become the main institutions responsible for ESD. Although the ESD concept was officially approved in 2011, various activities had started earlier, especially at the secondary education level, as evidenced by the Child programme. This programme took aim at introducing children to nature and the environment. Moreover, the Lessons for Saving programme took aim at educating pupils to save water, gas and energy to protect the environment and save natural resources. During the UN Decade of ESD, courses for lecturers were conducted but various challenges remain to be mastered. These include bridging the gaps of (i) insufficiently qualified teaching staff in ESD; (ii) insufficient networks for the exchange of experiences in ESD; and (iii) a lack of learning materials on ESD (e.g. on environmental protection, efficient use of natural resources and drinking water etc.). Therefore, filling various gaps became part of the mandate of the UNESCO Chair of ESD, which was established in 2011 at the State University of Urgench, with the support of the

Center for Development Research (ZEF) at the University of Bonn, Germany, and of the Natural Sciences Sector of UNESCO.

Laying the foundation for a Chair on Education for Sustainable Development in Uzbekistan

Starting ESD from scratch in an environment, which only recently was exposed to these principles, demands targeted and focused preparation. Uzbekistan, like all other Central Asian countries, is confronted with a degradation of natural resources that is unlikely to be halted in the near future. Creating resilient and sustainable agricultural and natural ecosystems is, therefore, urgently needed. This demands a comprehensive concept, coordination, cooperation and vision. To this end, the ZEF/UNESCO project, Economic and Ecological Restructuring of Land and Water Use in the Region of Khorezm (Uzbekistan), addressed how science, knowledge, and innovation can reduce natural resource loss, and resource-use inefficiencies, in order to benefit livelihoods and sustain environmental health. The concept aimed at defining sustainable options for

land and water use. These encompassed ecologically and economically sound practices to increase resource-use efficiencies, fight land degradation, mitigate greenhouse gas emissions, and increase rural incomes. The project was developed and implemented during 2000-2012 by ZEF in cooperation with the natural sciences sector of UNESCO, the German Space Agency (DLR), the University of Würzburg, Germany, and the State University of Urgench (UrDU), Uzbekistan, with financial support from the German Federal Ministry of Education and Research (BMBF). In this framework, a suitable infrastructure was set up at UrDU to support advanced research and education. As part of the preparation, helping UrDU to build human capital and develop excellent, application-oriented curricula for ESD has been an essential contribution, both in the quest for sustainable development, and in line with the Agenda 21 Declaration of UNCED in 1992. Between 2000 and 2012, a new generation of men and women in Uzbekistan were trained and prepared to become future teachers and decision makers. The pool of people trained and educated during a decade of collaboration of UrDU and ZEF/UNESCO is given in Table 1.

Table 1: Academic qualifications gained in the ZEF/UNESCO Project (July 2014)

		Uzbek Students		Non-Uzbek Students		Total
		Female	Male	Female	Male	
Ph.D.	Completed	9	9	8	12	38
	Ongoing	7	4	3	2	16
M.Sc.	Completed	30	40	15	20	105
B.Sc.	Completed	66	21	2	1	90

Source: Authors

It was clear from the outset that the core of UrDU staff would be young and lacking in exposure to updated educational methods and teaching skills. Therefore, as a second pillar of the preparative work, facilities such as offices, laboratories, library, computers, and field and lab equipment for field experiments, were modernized. In addition, databases and maps created by the project were transferred to UrDU. However, human capacity

building activities did not only include programmes in higher education, but also included initiatives aimed at technical and supporting staff. As well as having trained technicians, the soil, chemical and Geographic Information Systems (GIS) lab, established with the support of BMBF and ZEF, has been fitted out with modern measuring devices, various tools, and equipment.

To build on this development, and to prepare people for the challenges of the 21st century, a request was made for the establishment of a special UNESCO-ESD Chair aimed at introducing up-to-date curricula, and developing teaching materials with partners. In June 2011, the UNESCO Chair in ESD was established at UrDU with the support of the education department of UNESCO and the National Commission of the Republic of Uzbekistan for UNESCO (NATCOM). The ESD Chair is integrated into the faculty of biological/natural sciences at UrDU (Box 1) but draws heavily on the experiences and findings of the aforementioned ZEF/UNESCO project.

Box 1: UNESCO Chair in Education for Sustainable Development

The State University of Urgench (UrDU) is the largest institution of higher education in the Khorezm region of Uzbekistan, in Central Asia. Therefore, UrDU plays a crucial role in the development of this region. Helping this university to build human capital, as well as to develop excellent, application-oriented curricula for education in sustainable development, and also with the aim of restoring lost ecosystem services, is an essential contribution to the quest for sustainable human development. This is in line with the Agenda 21 Declaration of the United Nations Conference on Environment and Development (UNCED) in 1992. The UNESCO Chair, which is the first one on sustainable development in Central Asia, was initiated by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in Paris, by the UNESCO office in Tashkent, Uzbekistan, and by the National Commission of Uzbekistan to UNESCO (NATCOM).

On July 15, 2011, Prof. Dr. Paul L.G. Vlek was inaugurated as holder of this UNESCO Chair for a period of four years. The Chair is already integrated into the Faculty of Natural Science and Geography at UrDU. This conforms to UrDU's request to the ministry.

The buildings of the Chair have been provided by UrDU. They include classrooms for conducting training sessions and seminars, as well as modern laboratories, such as soil, chemical and GIS labs. These have been equipped by partners, namely the ZEF (the Center for Development research, Bonn) and the German Federal Ministry of Education and Research (BMBF). The Chair's budget comes mainly from UrDU, with further contributions from ZEF to support foreign lecturers. The UNESCO office in Tashkent is involved in the local promotion of this Chair

Based on the gaps identified, the overarching objective of the ESD Chair for the first five years was to contribute to the capacity building of a generation of lecturers and teachers, to integrate sustainable development into their curricula, and, thus, to improve the general awareness among the population both of ecological sustainability, and of how this can contribute to improving their livelihoods. Together with the founder members, the ESD Chair pursued six objectives: (i) contribution to a high-quality Master's degree programmes; (ii) capacity-building of the teaching staff; (iii) promotion and support of research activities; (iv) facilitation of networking, linkages, exchange and interaction among stakeholders; (v) provision of new opportunities to incorporate education reform efforts in Uzbekistan; (vi) provision of technical and vocational education of farmers and land managers in sustainable modes of production and consumption. In this way, the Chair aimed to refocus education towards the acquisition of knowledge, skills and values related to sustainability, to the benefit of the people in the region. As well as improving their quality of life, a rethinking and reform of education would generate knowledge. Together with existing norms and values, this new knowledge is needed to (i) build a sustainable world, and (ii) develop enlightened, active and responsible citizens.

Capacity-building with staff and students

One major strategic goal of the ESD Chair has been the provision of computer-equipped classrooms for conducting training and seminars, as well as the provision of laboratories and staff. Since 2011, those working with the ESD Chair have been able to improve their competencies in environmental laboratories. The laboratories have been used for:

- Familiarizing future lecturers with the metrics of sustainability, as well as the limitations of these metrics;
- Human capacity building in laboratory analyses and teaching, including in the agricultural sector;
- Developing cooperation with various stakeholders in analyzing problems and seeking innovative solutions to environmental problems;
- Supporting research into scientific and technical solutions to environmental problems;
- Testing and implementing new technologies for the sustainable use of land, water and biological resources.

Students from UrDU have thus gained some of the practical experience needed for working in modern labs, and they will be able to work in and manage laboratories in the future. During the first years of the ESD programme, work in the laboratories encompassed the areas of:

- Organizing practical classes for students and interested stakeholders on soil degradation, water quality and biodiversity;
- Analyzing samples in the framework of research activities on environmental issues and sustainable agricultural innovations;

- Offering students (future lecturers and teachers) an opportunity to gain hands-on experience of laboratory methods and their limitations;
- Teaching environmental monitoring and mapping through remote sensing and GIS tools.

All data are stored in a database in order to enable quality control over the long term and so support research and education. Also, the findings will be used for environmental monitoring, further re- search, modeling exercises, and helping relevant stakeholders in reaching economic and ecological sustainability in the region.

Education and research for sustainable development

Rather few young people in Central Asia are interested in studying science (Mukhammadiev, 2010). Following the establishment of the ESD Chair, the first classes (with an average duration of 1.5 hours per week) started in the autumn of 2011, and lasted throughout the academic year. The classes were attended by a mixture of Bachelor of Science and Master of Science students, and, later, by farmers and agricultural specialists. In total, 25 classes on 15 topics were taught covering a wide variety of issues. These issues included the Rio Conventions and their implementation in Uzbekistan, climate change and climate variability, negotiations on climate change, carbon and nitrogen cycling, land conservation, water resources, and many more. In addition, internationally prominent lecturers in sustainable development have been invited to give block courses and lectures, and assist with curriculum development. Some courses were offered through the long-distance facilities of UrDU, which made it possible to expose students to world-class higher education.

Lectures focused on practical solutions for achieving sustainable agricultural production and sustainable development by integrating the concept and ideas of sustainable development into the curricula of UrDU. The aim was to develop and improve education and

shape the minds of students, young researchers, and experienced lecturers alike, to think and act in terms of sustainability. Short, comprehensive lectures on concepts of sustainability, as well as methodological approaches to integrating these concepts into the disciplines taught at UrDU, have been developed and presented across the faculties. At the time of writing, UrDU together with three other universities in Uzbekistan is preparing to roll out a special training module entitled 'Sustainable Development and the Rational Use of Natural Resources'.

The ESD Chair supports various research activities in collaboration with national and international research organizations. These include research into salt-tolerant wheat varieties on degraded croplands, into agricultural extension services, and into the cost-benefit analysis of Clean Development Mechanism (CDM) projects in Uzbekistan. They also encompass research into the introduction of sustainable agricultural practices and water-saving technologies, and surveys to capture the perceptions, readiness and willingness of households to cope with climate change.

Lessons learned

Higher education faces the continuous challenge of searching for new ways to enhance the quality of the entire learning process. The first years of ESD in Uzbekistan underscored the importance of adequate staff and facilities, etc., as well as of an effective use of information technologies (IT) in all areas of ESD activities. The use of this innovative form of communication – innovative, at least, for Uzbekistan – and the creation of a high-tech information environment at UrDU, turned out to be a most important driver for luring talented young people from across the region. This confirms the assertion by UNESCO that ICT will contribute to building a better world in which everyone will benefit from the advances of education, science, culture and communication. The inclusion of IT in education has accelerated the transfer of knowledge and experience, which is the essence of education. The introduction of modern information and communication technologies has also contributed to the quality of teaching, and to the renewal and reform of the education process, regardless of age or other social characteristics. The increased use of IT has had an

enormous impact, enhancing the quality of learning, teaching, and communication. These experiences illustrate that the national government, which is paying greater attention to a broader introduction of modern IT in the education and training of young professionals, has chosen an appropriate pathway. Through the use of video conferences and seminars, it is supporting and developing a unified national system of electronic educational resources that is optimizing and unifying the effectiveness of higher education institutions.

ESD at UrDU has also demonstrated the benefits of ICT for improving the university administration's organization and management of educational processes. Initiated by the ESD Chair, an electronic system was developed, and then piloted, to measure the extent to which the quality of teaching had improved. One decisive factor during the training of qualified personnel turned out to be the secure access to a broad range of educational and research information for active learning. At the time of writing, UrDU's Common Database Information Resource Center has more than 300,000 titles of scientific and popular literature. Now, thanks to fiber-optic networks, computers and computer labs have high-speed Internet connections. There is also now Wi-Fi access in all campus buildings and student dormitories. This form of international collaboration was, therefore, an important factor in ensuring the sustainability of educational opportunities.

Optimizing university management has also been crucial to ensuring objectivity and transparency, and to improving the entire educational process. This approach, in clear contrast to conventional teaching in the Uzbekistan, has led to the permanent involvement of lecturers and staff in the educational process. The expanding competencies of the educational staff have improved educational quality, and the introduction, at the same time, of an online rating system, has allowed lecturers and students to effectively monitor this educational process. Another important feature has been the transparent and objective approach to monitoring. For instance, each student has unlimited, access, including from a remote location, to all statistical data relating to his or her performance in each subject. Furthermore, improved accounting of the teaching load of lecturers has gradually improved the organization of the educational process, on both a semester and

a modular basis. The permanent documentation of the activities of lecturers, departments, faculties, and the broader university, and their inclusion in the database, have meant that the status of teaching and research work of both individual lecturers, and of the department as a whole, have been accessible at any moment. The resulting assessment of work performance, comprehensive and transparent in nature, has also been linked to future professional advancement. Thus, the implementation of such IT programs has enhanced both the effectiveness of (financial) management, and, in turn, the sustainability of the educational process.

Conclusions

Establishing an ESD chair, in an environment with little previous interest in the topic, has demanded a flexible approach in order to win over the teaching staff. Combining exposure to sustainability concepts with the use of ICT innovations to entice young staff and to create objective measures of performance was the key to the successful introduction of ESD in Uzbekistan. Furthermore, the establishment of the ESD Chair was necessary for pushing ESD forward, and for achieving full acceptance by the responsible institutional bodies, by the State Committee for Nature Protection, and by the ministries of public education and of higher and secondary specialized education. The establishment of an ESD chair in this region should, however, be seen as a long-term endeavour requiring the constant reviewing of goals and plans, and their adaptation as needed. In this sense, the prospective guidelines from the UN Global Action Program on Education for Sustainable Development, beginning in 2015, are of great importance once integrated into the national higher education strategy in Uzbekistan. The revised working plan of UrDU should gradually steer its ESD offerings into close collaboration with national and international education communities working on education for sustainable development. The ESD Chair will also strive for collaboration with institutions in the region to increase their capacities for providing high-quality education. The integration of the recently established ESD Chair into the structure of the entire university has gradually been receiving greater attention. Ideally, the UNESCO ESD Chair would be integrated into UrDU and then replicated in the form of several fully fledged ESD Chairs around the country. This would help alleviate

the present deficiency in qualified teaching staff in ESD and the lack of suitable and region-specific textbooks and teaching methods. Moreover, it would hopefully generate the necessary resources to overcome these bottlenecks.

Although the present burden on the ESD Chair is higher than previously anticipated, the final payoffs will be substantial. It is essential to continue this development given the cost of inaction experienced during the Soviet era. The long-term plan is to develop the ESD Chair into a centre of excellence at UrDU, becoming a 'think tank' for developing new solutions in the field of sustainable development, environmental protection, and energy supply. It will be active in updating educational material, creating textbooks, and, most importantly of all, in integrating the concepts of sustainable development into the curricula of all the faculties of UrDU.

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Policy Issues Related to Inclusive Education for Sustainable Development in Cameroon

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Introduction

In all nations, quality education has been at the very heart of progress towards sustainable development because of its implications for empowering human capital for socio-cultural and economic growth. In order to succeed, such education must be driven by a well-designed, constructive policy reflecting the needs and interests of all people in a nation. The potential of such education to empower each individual is based on the extent to which all stakeholders are engaged in education policy design. Naturally, such a process has to move beyond armchair theorizing by politicians and administrators whose policy prescriptions are not commensurate with the realities of the various contexts of education. In most cases, the ecological and cultural perspectives, as well as the existing knowledge, of those for whose benefit such education is planned, are not even considered. Yet there is still a continuous outcry, in the 21st century, at the predominance of colonial education systems. These continue to marginalize the real learning needs, interests, and, consequently, the actual potential of the learner to solve immediate livelihood problems. Since indigenous knowledge systems are still only loosely integrated into most curriculum content, the relevance of education as a mechanism for sustainable development still faces serious problems. When an education system is examination-oriented, teaching will be based on a rhythm whereby teachers are rushing to complete the syllabuses because quality is judged quantitatively on the percentage of passes. Efforts to employ cultural pedagogic strategies of participation,

observation, hands-on collaboration, and cooperation, are missed, while the dominant pedagogic practices are those of lecture and drill. This encourages learning that is mere memorization and rote learning, without understanding. Such practices are often due to large class sizes, teaching in multi-grade and multi-age groups, and, above all, the poor remuneration given to teachers, which does not allow them to carry out research into new teaching methods. In a classroom with such diversity – including issues of gender, and of children with disabilities, difficulties, and in disadvantaged situations – children's real potentials are never really well nurtured. In addition, for education for sustainable development to be experienced, education policy should address quality issues of decentralization, autonomy, accountability and good governance, and inclusion. These are strategies to ensure comprehensive, reflexive, flexible and constructive engagements on the part of all education stakeholders. To ensure that the above goals are being achieved, policy must put in place mechanisms for monitoring and evaluating the education process. Yet to a large extent, these are not evident in education policy statements. Or, if they do exist, they are not well articulated.

Though education for sustainable development may mean different things for different stakeholders in Cameroon, essentially it is the extent to which the government has attempted to ensure that education policies address socio-economic, cultural and environmental concerns, in addition to pedagogical issues. Cameroon is a bilingual English- and French-

speaking country, with two sub-systems of education. The National Education Forum in 1995 introduced education policy reform that was enshrined in new legislation in 1998. These two efforts attempted to strengthen the role of education as an instrument of change, by ensuring that it addresses Cameroonian cultural realities. Such attempts should harmonize education offerings through the various contents, methods and assessment procedures in all disciplines, and at all levels, while also accounting for education for sustainable development.

The conceptual and historical perspective of education for sustainable development in Africa

In December 2002, the United Nations General Assembly adopted Resolution 57/254 proclaiming the period 2005-2014 the Decade on Education for Sustainable Development (DESD). This declaration called for all Member States to have ESD integrated in their educational plans and systems (UNESCO, 2006). UNESCO was appointed the Lead Agency, and given the mandate to develop an international plan for the implementation of the UN Decade. Although two of the Millennium Development Goals (MDG) related specifically to the provision of universal primary education (Objective 2) and equality between sexes in education (Objective 3), it is worth acknowledging that ESD, as a holistic concept, is an implicit condition for attaining all other objectives. ESD is an essential link in the chain between poverty reduction and a healthy environment. Furthermore, the efforts made during the UN Decade on Education for Sustainable Development have strengthened the activities conducted within the framework of Education for ALL (EFA) and the United Nations Decade for Literacy (UNDL), all of which contributed to the attainment of the Millennium Development Goals.

The UN's Decade on Education for Sustainable Development, and the second Decade of Education in Africa launched by the African Union (AU) in 2006, acted in perfect synergy. The two initiatives proved to be mutually reinforcing, the objective of the latter being to extricate the continent from its 'deficit' in

terms of education. Special attention was given to insufficient capacities and resources, as well as to the negative impact that they have on education, the uncertain economic growth, high population growth, armed conflicts, structural adjustment programmes, etc. Furthermore, there was a feeling that the issues relating to good governance ought to be a basic concern since the implementation of the strategy implied favourable working conditions (UNESCO, 2006).

UN Decade of Education for Sustainable Development in Cameroon

The education system has attempted to address curriculum issues for sustainable development at all levels. These issues include climate change, health, water and sanitation at nursery and primary levels of education. A project on teaching strategies for environmental education in primary schools was funded by the University of Yaoundé 1 (Tchombe, 2003). The findings have important implications, not only for classroom practices, but also for teacher education and training. Training and capacity-building were also addressed in the domains of biodiversity, poverty reduction and so on, at the level of formal education. All of these concerns are equally being addressed at the level of non-formal education, with much emphasis placed on agriculture and food security. Cameroon has a population of 20,549,221 with 10,233,926 females and 10,315,295 males (Index Mundi, 2013). The school-going population is 49.1% (Index Mundi, 2013). Of these, there are about 1,600,000 people living with disabilities. To achieve Cameroon's vision of development, even though great attempts are being made to adhere to most of the international initiatives that aim to provide support, much still needs to be done.

Cameroon is a member of the Education for Sustainable Development in Africa (ESDA) initiative, which is a three-year United Nations University (UNU) project that develops and implements a graduate-level training programme for teachers and professionals in education for sustainable development in Africa. The United Nations University Institute for Sustainability and Peace (UNU-ISP) is working in collaboration with Japanese universities in this area, and using its network

of universities and higher education institutions in African countries. The principal aim of this project is to promote education for sustainable development in African countries through the training of teachers and professionals, who may then serve as planners, organizers and instructors for ESD programs in these countries. An open symposium on the role of universities in the promotion of higher education for sustainable development in Africa was held at the UNU Centre in Tokyo on 27 February 2009. The symposium addressed sustainability challenges in Africa, including issues relating to natural resources and degradation, as well as urbanization. It also featured presentations on the subjects of core competencies for sustainable development in Africa, and also the mainstreaming into African universities of questions of environment and sustainability, as well as a variety of other themes.

An institutional collaboration has started between University of Yaoundé 1 (UY1) in Cameroon and the United Nations University. The university's management, faced with structural challenges due to a rapid increase in student numbers, and aware of the potential of e-learning, decided to elaborate a plan of action to improve the access to, and quality of, its academic programmes. The project leader, Professor Mama Foupouagnigni, together with a multi-disciplinary team of dedicated professors and support staff, worked on a strategic plan to deploy e-learning at the university.

A first pilot phase was established to create an e-learning centre, and to produce five e-learning course modules. UNU supports this project and, with financial support from the Humboldt Foundation, in 2008 invited Prof. Foupouagnigni to stay on as a visiting professor for two months to gain expertise by working with e-learning experts at the United Nations University Vice-Rectorate in Europe (UNU-ViE), to elaborate the plan, and to meet with different German university experts and donors (Germany's academic exchange service, the DAAD; private companies). Current and future phases include capacity-building for the e-learning team, hosting the e-learning centre, and producing the first series of e-learning course contents. The plan is to leverage additional resources and to mainstream e-learning practices at the university to a greater extent.

At the University of Buea, as is the case of most university institutions in Cameroon, the BMD system (Bachelor's, Master's and Doctorate) was implemented as a strategic plan. This led to the introduction and implementation of many professional programmes at the undergraduate and post-graduate levels. Programmes have also been professionalized, and new faculties, such as Agriculture and Fisheries, have opened. Most programmes have been reoriented towards entrepreneurship, enabling graduates to create jobs and generate their own income upon graduation. The new approach has shifted more of the responsibility for learning to the students, with a focus more on learning processes than on teaching.

UNESCO Chair for Special Education Needs

The UNESCO Chair in Special Education Needs (SEN) and Inclusive Education (IE) was created at the University of Buea in 2009. This service aims to provide an enabling environment for students with special learning needs. It has a responsibility for building capacities among staff in this area of specialization. Special education needs and inclusive education have three major components: curriculum adaptation, assistive technology, and human resources. Using these three components as a yardstick, the UNESCO Chair in Special Education Needs and Inclusive Education is geared towards providing most enabling environments (MEE), or the least restrictive environment (LRE), for students with special learning needs, both at the University of Buea in particular, and in Cameroon in general. This is evident not only in the undertaking of research and publications, but also in the acquisition of assistive technology. Key aims here are to give each learner a chance, and to promote community outreach.

The above discussions illustrate that no single institution can manage the issues related to sustainability. From the educational perspective, UNESCO's major concern about equity, access, and inclusion, led to the creation of the UNESCO Chair to ensure that these goals are achieved. Special education needs and inclusion are critical in this context. In this regard, the University of Buea is responding to the expectations of the International Conference of Education, held in Geneva in 2008. This

conference, in which Cameroon participated, provided a forum to all members, including ministers of education, for policy dialogue from the perspective of inclusive education. The UNESCO Chair has the important role of implementing the vision of the conference by building the institutional capacity both for research, and for delivering quality education to people with disabilities and in difficult and disadvantaged situations in central and western Africa. With support from UNESCO, it is expected that the Chair will promote an integrated system of research, training, information and documentation in the field of special needs education and inclusion. If projected resources are made available, the Chair is to serve as a means of facilitating collaboration amongst high-level, internationally recognized researchers and teaching staff, both at the university itself, and at other institutions in Cameroon and the sub-regions. The Chair of the University of Buea draws on the experiences of the UNITWIN/UNESCO Chair Programme as a stimulus for academic mobility and the rapid transfer of knowledge through twinning, networking and other linking arrangements.

The Chair's vision on the creation of a Diagnostic Centre for Screening and Intervention is being implemented. Presently, there is a computer laboratory, a laboratory with basic equipment for the visually impaired, a body analysis and learning disability laboratory, and an audiology laboratory with basic assessment equipment. With three programmes (Bachelor's, Master's and Doctorate) in special education, this centre will enhance clinical activities and the university's mission of outreach, whereby parents of children with disabilities can be screened for diagnosis and eventual intervention. Parents will be able to receive counselling on how to manage their children's conditions. The activities of the Chair will continue in this direction to enhance and enrich inclusive practices and research.

The success of sustainable development, and of the activities implemented thus far, depends on their acceptance by the stakeholders involved. The implementation of the strategy necessarily involves community participation, and it should be supported by good and well-designed national policies. One of the ways to push forward ideas of sustainable development in Cameroon is to implement stringent legislation to

meet the educational needs of people with disabilities in regular schools.

Box 1: The Chair on Special Education Needs and Inclusive Education

The Chair was created in 2009, and was appointed in 2010 at the University of Buea. As a mechanism for sustainability, the Chair provides and supports the Special Education Needs programmes, offering laboratories for the exchange of experiences and knowledge among universities and other higher educational institutions. In addition to these, other objectives of the Chair include:

- Developing institutional capacity through post-graduate programmes in special needs education;
- Conducting action research to inform social policy and appropriate educational practices for the attainment of quality scholarship and good practices at national and regional levels, which should align with international levels and standards;
- Training school administrators in special needs education;
- Training specialists in educational technology for special needs education, with skills for developing didactic materials to support remediation programmes.

The Chair has organized and participated in international workshops, conferences and policy dialogue forums whereby rich experiences were shared and best practices learned, particularly in the domain of policy. The issues of policy for inclusive education for sustainable development requires much reflection, as the deficits in this perspective can be seen in poorly trained teachers, in inadequate or irrelevant education programmes, and in disability unfriendly infrastructure. The Chair's research outcomes (Tchombe, 2014) have illuminated, substantiated and created awareness of these deficiencies. Indeed, these deficiencies obstruct universal access to education for sustainable development in the following dimensions.

Firstly, they illustrate that there are, in all classrooms and all communities, people living with disabilities, facing difficulties, and living in disadvantaged conditions. The fact that the relevant institutions are unprepared to fully engage all these individuals demonstrates that not all Cameroonians have the opportunity to participate in all forms of development in their respective communities. Secondly, it demonstrates the need to make educational institutions more disability friendly in all dimensions. Thirdly, the findings emphasize the need for qualified personnel. Fourthly, the findings strongly recommend South-South and North-South collaborative research, with universities engaging with schools to understand the realities of education practices, so as to better inform policy. Finally, there is an invaluable role and need for strong policy, with guidelines for implementation jointly formulated with contributions from all stakeholders (e.g. children, parents, teachers and the community, among others).

Policies and institutional developments on inclusive education in Cameroon

All children have the right to learn, as set forth in the Convention on the Rights of the Child (CRC), which virtually all governments in the world, including Cameroon, have ratified. Moreover, all children can learn, without regard to their physical, intellectual, social, emotional, linguistic, or other conditions. This includes children with disabilities and the gifted and talented, street- and working children, those growing up in remote or nomadic populations, children from linguistic, ethnic, or cultural minorities, children affected by HIV/AIDS, and those from other disadvantaged or marginalized areas or groups. Furthermore, while all children can learn, they may not all learn the same things at the same time, and with the same results. This is completely normal and acceptable.

In order to meet this challenge, it is generally agreed that schools need strong inclusive policies and philosophies that support the right of all children to

participate in an inclusive way (Lupart, 2002; Bunch, 1999). According to Raymond (1995), the tenets of a positive inclusive philosophy include the fact that every learner has the right to participate in all aspects of school life. In addition, a Saskatchewan Teachers' Federation report (1986) states that inclusion goes well beyond the mere idea of physical placement and assimilates the basic values of participation, friendship and interaction. In line with these and other global initiatives, we find that African governments have undertaken measures to ensure the educational rights of children, irrespective of disabilities.

The main innovation worth mentioning here is the adoption by the government in August 2009, of the Growth and Employment Strategy Paper (GESP). The GESP is a second-generation Poverty Reduction Strategy Paper (PRSP), and is one of the documents of the shared vision of Cameroon Development by 2035 (Vision 2035), covering its first ten years. GESP focuses on accelerating growth, creating formal jobs, and reducing poverty. GESP aims at increasing the average growth rate to 5.5% annually from 2010 to 2020. It also aims to reduce underemployment from 75.8% to, at the highest, 50% by 2020, thanks to the creation of tens of thousands of formal jobs every year. Moreover, another of its goals is to reduce the monetary poverty rate from 39.9% in 2007 to 28.7% by 2020. In order to meet these goals, the government intends to accelerate ongoing reforms, and to take all necessary measures so that improved economic performance translates into concrete results in terms of job creation, poverty reduction, and tangible improvements in living conditions, with particular emphasis on women and people with disabilities.

With this innovation, Cameroon has recently made considerable progress in the area of economic and social rights by adopting measures to protect and empower people with disabilities, especially in the area of education. On 1 October 2008, Cameroon signed the United Nations Convention on the Rights of Persons with Disabilities. Within the framework of harmonizing national laws with this new international legal instrument, the President of the Republic of Cameroon enacted Law No. 2010/002, of 13 April 2010, on the protection and empowerment of people with disabilities. This law focuses on the prevention of

disabilities, on the rehabilitation and psychological, social and economic integration of people with disabilities, and on the promotion of national solidarity towards them. This law repeals previous provisions, particularly, those of Law No. 83/013 of 21 July 1983 on the protection of people with disabilities. Circular letter No. 86/L/1656/MINEDUC/CTZ of January 1986 instructs school administrators to facilitate the admission of children with disabilities. This may be difficult with severe cases of disability if the school is not equipped to cater for these needs.

Highlights from decree No 90/1516 of 26 November 1990 address the modalities for applying the law. As stipulated in Article 1, 'the education of handicapped children and adolescents is assured in the regular schools, and in centres for special education'. Article 2 of the same decree says precisely that 'children with hearing or visual impairment and mental disabilities will benefit from special education that will permit them to register in regular school'. This approach addresses the integration model. This law also lays down the conditions for implementing the 1983 law that grants certain privileges to children with disabilities. These include an age waiver, financial support, and the right to repeat. Children with special needs (children living in poverty, orphans, street children etc.), with the exception of those with disabilities, do not benefit from this decree directly, even though these categories of children are equally vulnerable to being excluded from education.

Meanwhile, Law No. 98/004 of 14 April 1998 lays down guidelines for education in Cameroon, granting equal opportunities without discrimination of gender, political, philosophical and religious opinion, and socio-cultural, linguistic or geographical origin. The shortcoming of this law is that it makes no mention of people with disabilities. Furthermore, at no point in time have any of Cameroon's decrees and laws mentioned either the training of teachers, or the adaptation of the curriculum, to respond to the needs of inclusion. Other government measures to protect the welfare of people with disabilities include:

- The signing of a joint circular letter by the Ministry of Social Affairs and the Ministry of Secondary Education (MINAS and MINESEC) on 14 August 2007, to facilitate

the admission of students with disabilities, and of students born to parents with disabilities, to public institutions of secondary education, and also their enrolment in official examinations. These children are exempted from paying parent/student fees. This circular letter also relates to the identification of children with disabilities, and of those born to parents with disabilities, who are enrolled in government colleges.

- The establishment, since the beginning of the 2006-2007 academic year, of a training programme entitled 'Special Education Programme' in the Faculty of Education of the University of BUEA. This programme offers courses in sign language, Braille, and the psychology of people with impairments, at the end of which students are awarded Bachelor's, Master's or Doctorate Degrees in Specialized Education.
- The creation, in 2009, of the UNESCO Chair in Special Education, with the holder of the Chair resident at the Faculty of Education of the University of Buea.
- The training of young girls with disabilities at the African Institute of Computer Science (IAI- Cameroon) in information and communication technologies (ICTs); the training and support for the socio-economic integration of 85 people with disabilities for a total amount of CFAF 45,000,000 (US \$90,000).
- The drafting of a monograph, for each type of disability, about how it relates to work. This was subsequently made available to people with disabilities in order to raise awareness among all potential employers, and among job-search and placement agencies, of how people with disabilities can find employment in full respect for their dignity, and on an equal basis with others.
- The recruitment of people with disabilities in Cameroon's public service, support for income-generating activities, the provision of subsidies, and training and support programmes for the reintegration of people with disabilities.

- The early detection of disabilities, and the close monitoring of functional rehabilitation. These actions complement health programmes such as

the expanded programme on immunization, and the HIV/AIDS, malaria, tuberculosis and blindness-control programmes, which also target people with disabilities.

- Tax exemptions granted to private schools that cater for children with disabilities.
- The annual grant of equipment (tricycles, wheelchairs, white canes, hearing aids) and school subsidies to people with disabilities.
- Support for the socio-economic settlement of the graduates of the Vocational Training Centre for Women with Disabilities known as the 'Bobine d'Or' of Ekounou.
- The granting of subsidies to private social works, NGOs and associations that cater for people with disabilities, for a total amount of CFA 40 million francs.

In the field of higher education:

- The granting of the status of recognized spokespersons to representatives of students with disabilities. This justifies their effective participation in dialogue forums between the minister of higher education and the national student community (Forum of Students of State Universities; tripartite monitoring committee of meetings with the students of state Universities).
- The participation of students with disabilities in the University Games and all other recreational activities, and the promotion of a community spirit within higher education.
- The taking into account of the disability criterion in all forms of assistance and university welfare services. This includes, for example, the allocation of rooms in university hostels, the provision of assistance to encourage excellence, special aid to combat vulnerability, as well as work-study programmes and holiday jobs. As an example of how this works, one can note that awards for excellence (CFA 75,000 francs per beneficiary) were granted to 335 out of 1422 eligible students with proven disabilities and cases of social exclusion in the 2006/2007 academic year.

With regard to improving the access of people with disabilities into public buildings, the prime minister – in Circular No. 003/CAB/PM of 18 April 2008 relating to compliance with the rules governing the procurement, execution and control of public contracts – enjoined project owners and assistant project owners to integrate specific concerns regarding the accessibility of people with disabilities when designing and building housing, public buildings (especially schools), and road construction projects. These requirements are intended to ensure the implementation of the provisions of Decree No. 90/1516 of 26 November 1990, to implement Law No. 83/013 of 21 July 1983 on the protection of people with disabilities.

Following these instructions, the Ministry of Social Affairs, with the assistance of technical partners and organizations of people with disabilities, produced a practical guide on the accessibility infrastructure and public buildings to people with disabilities. This document, which was the subject of an agreement with the Public Contract Regulatory Agency (ARMP), ensures compliance with the standards contained therein both upstream (review of the terms of reference and the technical specifications of projects) and downstream (reception of the structures). The Guide was disseminated to the different social partners, and an agreement was signed on 8 April 2009 with ARMP, which is responsible for ensuring compliance with regulatory requirements in this area. The provisions of this practical guide for project owners, architectural firms, and the various policy makers, are based on requirements for access ramps to buildings, access gates, the width of corridors, name or sound plates, parking lots, seats in public transport, etc.

Furthermore, Law No. 2010/002, of 13 April 2010, on the protection and promotion of people with disabilities, strengthened the requirement to take account of people with disabilities in all construction projects involving infrastructure and public buildings. Sanctions, including criminal sanctions, are provided to that effect.

In the area of prevention, the following initiatives are worthy of note:

- Awareness-raising and education, through family planning and radio broadcasts, on the effects of

abusive labour and the importance of reuniting victims with their families. The National Commission on Human Rights and Freedoms broadcasts the weekly bilingual radio programme known as 'La tribune des droits et des libertés' (Forum of Rights and Freedoms);

- Guaranteeing free primary education, recruiting and training teachers, constructing and equipping schools, and creating education-priority areas in the eastern region, and the three northern regions. These measures are all in a bid to boost the enrollment rate and so to reduce child exploitation.
- Encouraging equity in education, especially for girls with disabilities. In June 2004, Cameroon, in collaboration with many NGOs, launched campaigns to issue birth certificates to the children of the Centre Region, and the North Region, who did not have them. This enabled these children to enroll in schools.
- The adoption and implementation of the National Education Programme on Human Rights by the National Commission on Human Rights and Freedoms (NCHRF). This programme is aimed at educating citizens on their rights and, consequently, at reducing child exploitation.

Conclusions

Despite all of the efforts made by the Cameroonian government, through legislation and policy, to protect the rights and wellbeing of people with disabilities, they are still excluded from the mainstream of society and denied their human rights. Discrimination against people with disabilities in Cameroon today takes various forms, ranging from invidious discrimination, such as the denial of educational opportunities, to subtler forms of discrimination, such as segregation and isolation because of the imposition of physical and social barriers. The effects of disability-based discrimination have been particularly severe in fields such as education, employment, housing, transport, cultural life and access to public places and services. This may result from distinction, exclusion, restriction or preference, or denial of reasonable accommodation, on the basis of disability. Such discrimination effectively nullifies or impairs the

recognition, enjoyment, or exercise of the rights of people with disabilities.

As a matter of fact, violations of the human rights of people with disabilities, especially the right to attend regular schools, have not been systematically addressed. Most disability legislation and policies in Cameroon are based on the assumption that people with disabilities are simply not able to exercise the same rights as non-disabled people. Consequently, the situation of people with disabilities is often addressed in terms of rehabilitation and social services. A need exists for more comprehensive legislation to guarantee the rights of people with disabilities across the board – political, civil, economic, social and cultural rights – on an equal basis with people without disabilities. Appropriate measures are required to address existing discrimination, and thereby to promote opportunities for people with disabilities to participate in social life and development on the basis of equality. Without all these, Cameroon will not be able to meet the objectives of the United Nations Decade of Education for Sustainable Development.

Some of the implications for the future work of the Chair are that it must renew its efforts to encourage partnership through community participation. It should do this in the aim of eradicating the cultural and psycho-social barriers that foster faulty beliefs about disabilities, and that consequently hinder the promotion of appropriate intervention. The target, therefore, is the parents and the opinion leaders in communities. These people must be engaged in related research and development issues that would lead to a change in mind-sets. Furthermore, the Chair will provide educational opportunities that increase awareness in the area, and that increase the chances for the participation of disabled people in social and economic development. It will do so through workshops that will create networks and links between homes, schools and the University.

An important step for the Chair is to promote a questionnaire with well-defined indicators, which every parent, older student, or pupil, can fill out to enable initial identification of disabilities, disadvantages, or even difficulties, with a view to potential interventions. In this connection, the Chair would lobby for a diagnostic centre, both to facilitate capacity-building,

and to allow screening for early identification and remediation. This will make a difference if a practice school is created at the university to facilitate all of the activities, including counselling services for individuals and families. Furthermore, rehabilitation activities will be initiated so as to engage the community, and institutions, in the quest to address issues related to people living with disabilities. The hope would be that they, too, can then engage in profitable livelihood exercises and, as a result, improve their well-being. These steps should enable teachers, who are the main architects, to be trained in teaching, facilitating individual learning skills, encouraging self-reliance, and improving learner and parental self-perceptions through trust and open communication.

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The Glass Ceiling in the Institutionalization of Sustainability in Higher Education in Mexico

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Introduction

The strategy with which UNESCO launched the UN Decade of Education for Sustainable Development (DESD), bore serious reflection as the Decade drew to a close. The stage was set for this UN initiative during the previous decade, beginning with the Rio Summit in 1992. During this summit, education was enshrined as a key issue in Agenda 21. Growing out of the priorities of various political agendas, education became a recurring rhetorical element in a number of speeches (González, 2003). Such critiques and opinions were voiced in Johannesburg, in 2002, where a number of additional proposals from other meetings and summits were incorporated into the final resolution (Education for All (EFA), Millennium Summit). The DESD thus grew out of this setting.

The UN DESD resurrected issues that, though still highly relevant, had remained frozen or inoperative since the Belgrade Charter in 1975, due to the failure of strategies to reach the desirable impact. The DESD not only sought to prepare citizens to meet the challenge of changing their behavior towards a harmonious relationship with nature, but it also sought to be a means of promoting, developing and implementing education for sustainable development. The DESD had two broad pedagogical interpretations. On the one hand, it was meant to be a medium for conveying 'appropriate' bodies of knowledge, attitudes, values and behavior. On the other hand, it represented a means of developing skills and opportunities for people to address issues of sustainability, so that they could determine for themselves alternative ways of living. Hence, the traditions and characteristics of each region or country determined the priorities in each case (Wals, 2009).

A national commitment with the Decade of Education for Sustainable Development was signed in Mexico in 2005. This initiative was channeled through the Secretariat of Environment and Natural Resources (SEMARNAT) and the Secretariat of Public Education (SEP). At that time in Mexico, there was growing momentum behind environmental education, and the community of environmental educators was growing. Several state plans were developed, and networks were formed to allow greater opportunities for exchange among educators, because there were also more data, and more analyses, that allowed efforts to be more coordinated and focused.

In higher education, two elements have coexisted. On the one hand, there is an external modernizing element, which seeks to permeate and generally to develop the field of education. On the other hand, there are local or regional educational elements that manifest themselves in a wide range of proposals. The result is an often inconsistent mixture of international politics with the local peculiarities of each institution. As a result, higher education institutions (HEIs) search for advantages and benefits that enrich their own initiatives. However, due to existing limitations, they often end up attempting to adapt international frameworks, or introducing concepts and tendencies without first undertaking a systematic change of the institutional programme over the medium and long term. Finally, such initiatives become guidelines that are rarely accompanied by educational management strategies, mandatory compliance schedules, or incentives that motivate HEIs to follow those guidelines.

In addition to these tensions, HEIs present difficulties in their organization that also limit the implementation

of the kind of significant changes that might have a greater impact on the university community. Finally, there are a number of institutional conflicts that add to the confusion, and result in differing understandings of sustainability, and of the mission of education itself.

The UNESCO Chair on Citizenship, Education and Development of Environmental Sustainability is an example of that confusion. Its presence at the University of Veracruz (UV), and its implementation, represent a subject of analysis that should be examined in conjunction with another relevant event: the creation of the Master Plan for Sustainability at the University of Veracruz (PlanMaSUV). Both initiatives were developed with high expectations for the university, and are intertwined in the initial stage; they intersect and contribute to both efforts. However, structural factors and limitations in funding ended up separating them. It is a story, among other problems, of the weakness of university institutional policies, of a lack of communication, of hierarchical dependency, and of a reliance on administrative management periods. This all generates a glass ceiling, a kind of 'maximum permissible level', for actions related to sustainability.

The UV Master Plan for Sustainability and the UNESCO Chair

The Universidad Veracruzana (UV) is the most prominent institution in southeast Mexico, with five campuses throughout the state. Since the early 1990s, UV has promoted many initiatives in environmental education (EE) in different areas. Moreover, it has maintained an active position on launching dialogue in this field. A great number of research studies have been produced that provided valuable findings on the environment. However, there have been no clear guidelines or strategies that managed to unify institutional policies for sustainability.

In 2005, the Institutional Plan for Sustainable Development 2005-2014 was adopted as a first attempt (Menchaca and Armenta, 2005). It was a proposal that was registered in the southern and southeastern network of the National Association

of Universities and Institutions of Higher Education (ANUIES), although it had no visible effect on the UV. The second attempt was in 2009, when the Institutional Plan Towards a Sustainable University was elaborated (Rodríguez and Vazquez, 2008). This plan arose in another important Mexican network: the Mexican Consortium of University Environmental Programmes for Sustainable Development (COMPLEXUS). Both networks had similar objectives, but different dimensions, alliances and strategies.

The Master Plan for Sustainability at UV was concluded in 2010. Unlike earlier plans, this one was presented to the University Council, the highest authority of the university. At the same meeting, the University Coordination for Sustainability of UV (CoSustenta) was approved, with the objective of organically integrating all components of sustainability in the institution's functions. The CoSustenta initiative was set up with a structure and its own budget, as well as broad authority to implement the PlanMaSUV.

For UV to carry out CoSustenta, it had to combine several elements. These included a growing number of research topics related to issues of sustainability, as well as approaches to the generation and application of knowledge (in graduate programmes, for example), that emerged at the initiative of different research groups. In teaching, it awakened the interest of many at the university to learn about, and to receive training in, the field of environmental education. This in turn helped them to generate learning experiences and projects for their students. Surveys and analyses conducted by UV personnel encouraged the university to play a more prominent and influential role in addressing social and environmental problems. Indeed, the demand from civil society and local authorities for UV to participate as a mediator in environmental conflicts led to the chancellor's decision to propose the acceptance of CoSustenta.

CoSustenta started with a foundation laid by predecessors, and by projects such as the Centre for Eco-literacy and Dialogue of Knowledge, and the UNESCO Chair for Citizenship, Education and Environmental Sustainability of Development. The latter had recently been created, and began the same year with a seminar on environmental education for

sustainability for graduate students, lecturers and members of the community.

Elements of the Veracruzana University Master Plan for Sustainability

The Master Plan is based on three core axes: a) the 'University System of Environmental Management' (SUMA); b) the Communication, Participation and Education of the University Community Programme' (COMPARTE); and c) the 'Environmental Dimension for Sustainability in Research and Technical, Professional and Postgraduate Training' (DISCURRE)¹. When the interdisciplinary team that designed the Master Plan for Sustainability at UV considered these three axes, they were looking for a way to organically integrate them into the substantive functions of the university, and into the General Development Plan 2025. This strengthened the university academic programmes and social outreach, based on a wide and committed participation of the university community as a whole (UV, 2010). However, the design anticipated an imbalance between SUMA and the other core elements. SUMA is organized into eleven performance areas. These are: waste and materials management; discharges and emissions; green and protected areas; traffic management and college transport; risk and environmental contingencies; efficient use of water; energy; office supplies; bioclimatic construction and maintenance; administration and green purchases; and community training.

SUMA is linked to COMPARTE because both seek to strengthen university-community participation through UV spaces and media. But accomplishing that goal also requires designing more creative methods for achieving synergy to impact society in the state of Veracruz. However, COMPARTE is less effective as a tool than as a core element where communication is an aim in itself. The connection between both core elements appears weak. Finally, DISCURRE should be given greater attention because it seeks to restructure the curriculum, not only in terms of the different undergraduate and

graduate curricula, but also in all areas of academic learning and creativity.

The imbalance between the core axes is not an accidental or isolated issue. More than a decade after the Talloires Declaration, traditional measures of recycling still prevail among universities (Shriberg and Tallent, 2003). At least half of the action plans registered in the ANUIES network gather their objectives in areas such as water, energy and waste management. The imbalance between the core axes of PlanMaSUV reflects the fact that there is more information and capacity to establish an environmental management system than there are strategies for appropriate communication or a critical transformation of the university curriculum.

The UNESCO Chair was established under the coordination of the UV Institute for Educational Research, and was linked with the implementation of PlanMaSUV. While the nascent CoSustenta quickly and efficiently structured the operational team and designed initial strategies, the newly founded Chair implemented promising activities. One strategy of the Chair was to connect the economic resources of different university entities related to education, environment and climate change. This coordination model was an emerging manoeuvre to alleviate the lack of resources allocated to Chair activities, which did not benefit from a fixed institutional budget, although this could have given it important organizational powers.

Institutional constraints: the impenetrable glass ceiling

Within a short period of time, CoSustenta was integrated by a small team organized into four sub-units. At the same time, it was necessary to build the University Network for Sustainability (RUS) to integrate all university areas. One of the changes sought for the configuration of the RUS was to avoid appointments other than members of the network who were academic leaders interested in sustainability. Originally, academic staff from all UV areas participated in the creation of the RUS. However, the network has since experienced changes, especially due to the varied and demanding responsibilities facing faculty members. In this sense,

¹ The acronyms SUMA, COMPARTE and DISCURRE mean joining, sharing and thinking.

competition among different faculty obligations has made them pay greater attention to other priorities.

While CoSustenta and RUS were established within two years, the Chair was left out of the allocation of UV funds. Fortunately, the Chair managed to obtain funds for environmental education projects by providing training for sustainable development and environmental education communication at the Centre for Education and Training for Sustainable Development (CEC- ADESU) of the Secretariat of Environment and Natural Resources.

Members of the RUS also participated in many of the activities carried out by the Chair in 2011. To a large extent, what was sought was to decentralize decision-making. However, the consensus was generated amid tensions around certain issues, such as the budget and the role of the university hierarchy in decision-making. In 2013, the Chair was forced to decrease its activities due to the depletion of the funds granted by the CECADESU, and to the university budget deficit. CoSustenta had, meanwhile, moved ahead, although it continued to face other types of limitations.

Currently SUMA (The University System of Environmental Management) is one of the most developed programmes at UV. The programme has developed a large number of proposals both for improving water, energy, and solid waste management, and also for construction guidelines and recommendations for administrative functions. Some of these proposals have been the result of extensive analyses conducted by UV specialists. However, most of their recommendations have not been implemented.

CoSustenta initiatives face university regulations that affect the participation of faculty members, staff, and students, because each group operates under different conditions, has different responsibilities, and has access to different university spaces. Thus, there has not been an initiative that enables these different actors to engage in practical activities, such as the efficient management of water, energy and waste. Some of these take place in different institutions or faculties where the fluctuation of both faculty members and students frequently impedes the sustainability of such practices. They then end up as disconnected experiences.

It has been difficult to implement elements that depend entirely on central administrative directives, because their management, application and evaluation are complex. The HERMES system is a case in point. This system is capable of managing, accelerating and reducing the cost of sending and receiving documents through an institutional website. The UV Information Technology Office developed this promising system. Still, even though it is an extremely necessary tool for handling print documents, it requires excessive use of consumables and energy, and increases costs and waste. HERMES is essential due to the distribution of administrative departments. Although it has been tested in some institutions, and many users have been trained since 2011, it is still not widely used.

In addition to the lack of definition for the use of this system, other issues inhibit the programme's adoption. On the one hand, the network, both fixed and wireless, and the computer equipment, are not adequate to allow access to HERMES from every part of the university. On the other, this would entail the abandonment of old practices of recording and tracking official documents and written communications.

Programmes promoting personal health have been developed, such as one aimed at reducing the consumption of sweetened soft drinks and bottled water. There are also two agreements that have been approved by the University Council: Bioethics, and the agreement for the University System of Fundamental Risk Management (SUGIR.) However, in both cases it is necessary to develop mechanisms for their promotion and operation.

Efforts to connect and involve the university community have been inadequate, in spite of the fact that all instruments that have been designed are detailed, clear and easy to access. Even though COMPORTE, one of the core ideas, articulated the need to use UV's own resources in order to achieve collective participation, it is clear that the current patterns of communication insufficiently encourage this objective. The search to find a more efficient strategy capable of influencing the university's various entities and dependencies remains yet to be completed.

Another of the core ideas, DISCURRE, also has not progressed. Since 2002, UNESCO established that the goal of the DESD was to change current educational programs at all school levels, in order to develop human capacities related to knowledge, skills, and lifestyle values that promote sustainable practices. However, curriculum revision is neither a simple issue, nor is it intended only to modify educational objectives and content. Following on from ten years of DESD transition, one of the most difficult challenges remains the interdisciplinary 'incorporation' of the environmental dimension into programmes, educational materials, and strategies, so as to equip students with the skills they need in order to learn about the relationships between different disciplinary fields, and complex environmental phenomena (Riojas, 2004).

For Fullan (2002), the dynamics of educational changes tend to be systemic, complex, and time-consuming. The key to real change is to change individuals within the university community. Fullan states that institutions cannot be changed if the individuals within them do not change. Hence, aspects like the organizational culture of educational institutions can be both the biggest obstacle, and a major facilitator of change. This means that proposing good ideas and guidelines for change (theorizing and developing innovative educational models) is only an initial, if still a very important, factor. Defining the possibilities for change in the particular context with which we are concerned is even more important (changing attitudes, socio-cultural and educational practices, forms of management and participation, taking on new roles or identities, etc.). In order to institutionalize change, the different university actors must change too.

In this process of individual transformation, CoSustenta has implemented an approach involving deep 'dialogue circles', and the training of facilitators. This approach has been seen as the 'backbone' of a transition in the sustainability process, through the continuous training of people's awareness, and intention, with the aim of making care and communication the foundation for learning, living and working in harmony and coherence.

Dialogue circles have been taken up by the CoSustenta, and have been developed at the UV's Centre for Eco-Literacy and the Dialogue of Knowledge. They are

based on the practice of open dialogue, which is a tool of great value for cultivating and developing the ability to communicate and think both individually and collectively. The possibility of generating a collective and systemic thinking process, one that addresses the problems and questions that are relevant and meaningful to the community, is constructed in the circle of participants through this constant practice of dialogue (Vargas, et al.).

Conclusions

The fact that CoSustenta has remained unmodified by the most recent administrative change has been an excellent start for the university. Its transition as an entity represents an important step that will allow for the continuity of university actions. This gives it some strength, despite the large university budget deficit, and sustainability policies that do not enjoy high institutional priorities at a time of austerity. The biggest risk that the relatively new CoSustenta has to face is that financial obstacles have reduced its ability to develop recommendations. As a result, they remain, primarily, as good intentions only.

The greatest hope must be directed towards addressing the different proposals in the core axis of DISCURRE, and promoting the unique UV experience, maintaining and institutionally protecting the Chair with its long-term training programmes that will unite members of other organizations, universities and branches of government. The Chair represents a potential space for learning, sharing and review. It is a hotbed of educators and developers of educational projects in different fields.

The university has many pending tasks, including the evaluation of the progress of programmes. Nevertheless, the Universidad Veracruzana can be considered as one of the HEIs that have remained active in building their own sustainability policies. The transition is definitely complex. The UN's DESD has been through a period of changes, of successes and failures, of showing and expressing the urgency of changes in the educational system, and of fundamental transformations that are more necessary than setting guidelines and sharing networks. The future requires a rethinking of each of our institutions, in context. It involves thinking about institutional policies in more harmonious and coordinated ways.

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Integrating Sustainable Development into Engineering Education:

The Case of the Politecnico di Milano

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A Global Framework of Intervention

Sustainable development represents a comprehensive and global paradigm. It requires a holistic approach involving innovative technological solutions, new business models, and the shaping of appropriate policies. It also requires changes in the way people live and act, and education plays a key role in fostering this change. Since the Earth Summit in Rio de Janeiro in 1992, there has been growing recognition of the critical role of education in promoting sustainable development, confirming that education should be considered a human right. To this end, in December 2002, the United Nations General Assembly proclaimed the UN Decade of Education for Sustainable Development (DESD) 2005-2014, emphasizing that education is an indispensable prerequisite for achieving sustainable development. UNESCO was designated as the lead agency to promote and implement the UN Decade. In this role, it has fostered a number of partnerships to engage multiple stakeholders (including international agencies and private sector players), utilizing all forms of public awareness, education and training in order to promote a widespread understanding of sustainable development (UNESCO, 2005). Through these partnerships, UNESCO has added an essential additional dimension to sustainable development. Culture is another pillar that is crucial to completing the framework from a holistic and integrated perspective. In this manner, the UN's DESD sought to enable every human being to fully develop the knowledge and skills necessary to take part in any decision-making process whose aim was to improve the quality of lives at levels both local and global.

The UNESCO Chair in Energy for Sustainable Development, established at Politecnico di Milano in 2012, has based its rationale on this framework, acknowledging the role of science, technology and innovation as central elements for a comprehensive global development. Indeed, the Chair aims to increase the number of energy professionals (e.g. engineers and researchers) with international exposure, in order both to promote an attitude of innovation and applied research from the Global North to the Global South, and to increase North-South and South-South partnerships for high-quality, effective research on sustainable development. In line with this perspective, the Millennium Project was launched in 2005, to propose strategies for harnessing the pervasive and profound potential of modern science and technology for achieving the Millennium Development Goals (MDGs). The initiative dedicated a specific task force to science, technology, and innovation. This task force reported on the need to develop national systems of innovation, and indicated the vital role that universities can play (UN Millennium Project, 2005). The strategy of the Chair also makes reference to UNESCO's Medium-Term Strategy for 2008-2013 (UNESCO, 2008). One of the objectives in this strategy consisted of 'developing policies, capacities and tools for quality education for all and lifelong learning as well as promoting education for sustainable development'. The focus on the issue of access to energy as leverage to fight against poverty, and to promote sustainable development, is also in line with the global initiatives of the MDGs, to which some of the goals, such as 'eradicate extreme poverty and hunger', 'ensure environmental sustainability', and 'develop a global partnership for development', were deeply related (UN, 2014).

The Chair has mainly addressed its recent actions towards the North African Mediterranean region and the Sub-Saharan countries in East Africa. Indeed, the topic of science, technology and research for socio-economic development, with a specific focus on access to energy and sustainable energy, has become a priority in Africa (UNESCO, 2007). As recognized and affirmed in the Maputo Declaration adopted by the African Union Conference of Ministers in charge of Energy in November 2010 (African Union, 2010), the energy issue is considered highly relevant for the development of the African continent, where the current, highly fragmented, situation of energy policies is one of the biggest challenges being faced (Mandelli et al., 2014).

Energy and Development

Energy is a prerequisite for providing essential services to local development. For this reason, there has been a growing worldwide interest over the past decade in the energy challenge, and in sustainable energy strategies. Access to modern energy facilitates water purification and sanitation, food security, and cleaner means of cooking and heating are key in this regard, as are adequate healthcare, education, work, and information and communication technologies (ICTs). For instance, in rural areas of developing countries, modern forms of energy reduce the amount of time women spend on domestic tasks, enable access to educational media and communications in schools and at home, mitigate the impacts of indoor air pollution, allow access to better medical facilities for maternal care, and enhance income-generating activities. However, energy is still not available to all. Today, almost 1.3 billion people live without access to electricity, and 2.6 billion people rely on traditional biomass for cooking, on three-stone fires, and for lighting (IEA, 2013). For many of these people, especially those who live in rural areas of developing countries, the key issue is access to energy, either in terms of quality (i.e. access to modern fuels), or quantity (i.e. access to sufficient amounts of energy resources). Indeed, not only is the current energy situation in many developing countries responsible for health and environmental effects, as is well documented, it may also cause economic losses for productive services and basic processes that require reliable and affordable energy supplies.

In 2012, the United Nations Rio de Janeiro Conference on Sustainable Development resulted in an agreement by the member states to launch, over a 15-year timeframe to 2030, a set of Sustainable Development Goals (SDGs) that overcome the limitations of the Millennium Development Goals (MDGs). The MDGs did not include global challenges specifically related to energy issues (United Nations, 2012a). The SDGs aim to introduce a comprehensive development paradigm for developing, emerging, and developed economies, while also tackling other pressing challenges at a global level. In order to support these objectives, the United Nations Secretary General launched the Sustainable Energy for All (SE4All) initiative (United Nations, 2012b), which aims to ensure universal access to modern energy services, doubling the rate of improvement in energy efficiency, and doubling the share of renewable energy in the global energy mix by 2030. Within this new paradigm, SE4All aims at fostering sustainable development as a central element, capable of taking into account the needs of people and of society, and with equity as an essential consideration for managing resource distribution. Thus, in order to guarantee both a reliable energy supply in high-income economies, and a reduction of poverty in developing countries, integrating sustainable energy strategies into national policies, and guiding international cooperation efforts to deal with the energy challenge, is truly urgent. It represents the direction suggested by the international community, and requires a framework within which all actors, including those in academia, are able to contribute their own particular expertise and competences.

Objectives of the Chair

In line with the institutional and international framework, which recognizes the importance of education for sustainable development, and which acknowledges the key role that energy-provision plays in this process, the Chair has addressed its mission towards the promotion of an integrated system of research, training, information and documentation on energy for sustainable development. Aiming at facilitating collaboration among individual high-level, internationally recognized, researchers and teaching staff, together with research institutions, the specific objectives of the Chair can be summarized as follows:

- To carry out joint studies and research on access to energy, on energy efficiency with an impact on the development of energy systems, also by ensuring cooperation between industry and academia;
- To foster capacity-building for the establishment and implementation of energy systems based on the use of local energy sources (including local human capital), and appropriate technologies to cover energy needs;
- To facilitate opportunities for North-South, South-South and multiple-stakeholder cooperation in research, teaching, knowledge-sharing and networking in the field of energy for sustainable development.

Box 1: The Establishment of the Chair

The challenge of promoting sustainable development has become a mission at Politecnico di Milano through a number of activities supported by the UNESCO Chair in Energy for Sustainable Development in the Department of Energy.

The establishment of the Chair, in March 2012, is the result of increasing efforts by Politecnico di Milano in the fields of access to energy and sustainable development in developing countries. Indeed, the activity of the Chair represents the natural fusion of two main topics undertaken by the institution, and developed in recent decades. One of these main topics is cooperation for development, as part of one of the pillars of the academic mission. The other is advanced research in the energy sector, carried out by the Faculty of Industrial and Information Engineering.

The Chair can draw on the resources of the research group of the Blaise Pascal Laboratory in the Department of Energy. Moreover, collaboration with other research groups at Politecnico di Milano has intensified over the past few years, and joint research programmes have been established, including groups from the Department of Energy, from the Department of Management, Economics and Industrial Engineering, and from the Building Environment Science & Technology Department (BEST).

The activities of the Chair are partly funded by the host institution, which provides it with human resources. Private partners also contribute project-based funding, and there is also European Union project-based funding for human resources. Another source of funds is from the provision of research advisory services, training activities, and the production of teaching material.

Academic strategy and actions of the Chair

Given the deep connection between energy and development, an increasing lack of engineers who operate both with competence, and with a global outlook, is starting to become evident. As a result, Politecnico di Milano aims at ensuring that a new generation of professionals and citizens will have the methods, knowledge, and tools, to address current challenges with a comprehensive approach. Such an approach merges technical training with an understanding of social, economic and policy dimensions.

The main elements of the strategy of the UNESCO Chair in Energy for Sustainable Development can be defined by relating them to the three pillars of the academic mission, and to the three main objectives of the Chair itself: research, education, and technological cooperation or service to the community. Indeed, all three of these elements aim to contribute to a paradigm shift towards more sustainable and equitable energy systems, able to meet the needs of global development.

1. Research for Innovation and Development

The vision

It is crucial for scientific researchers to foster relationships with local industry and the local community while preparing strategies for autonomous development. The selection, design, development, and optimization of a technology should be performed by considering the fit between resources and needs in the socio-environmental context, with a multi-stakeholder perspective. Indeed, research includes energy analyses of different scenarios, and the development of technologies that are needed. The choice of appropriate solutions, and the attention paid to concepts of long-term maintenance and people's empowerment, are important in order to maximize the effectiveness and efficiency of implemented technologies, and to generate positive impact over the long term.

Starting from this perspective, staff exchanges and joint projects are being implemented that are tailored to increase the sharing of knowledge among the research staff of the participating institutions. Incoming PhD students from developing countries carry out part of their research activity at Politecnico di Milano, in order to acquire additional skills and competences needed for their research. Meanwhile, outgoing PhD students develop such tools in the field, thus completing their training.

The actions

There are two major lines of research. The first addresses integrated renewable energy systems. Its focus is on sustainable strategic planning and appropriate technologies for distributed generation, off-grid systems (micro-grid), and domestic energy services (cooking stoves and biogas systems). The second is focused on performance-measurement modelling, and on the development of a comprehensive monitoring and evaluation (M&E) framework to help with the long-term assessment of the impact of energy projects on local development.

Active research projects include:

- Planning sustainable strategies for improving access to energy;

- Matching needs and resources: assessment of needs and analysis of resources;
- Demand-side energy planning relative to local contexts;
- Analysis of current rural household energy solutions in developing countries;
- Optimization of energy-conversion technologies in rural areas;
- Development and implementation of energy planning methods for off-grid and on-grid distributed generation;
- Design models for off-grid energy systems for rural electrification (such as photovoltaic stand-alone systems and solar pumping systems);
- Multi-criteria, multi-objective, and multi-stakeholder decision-making and analysis, for strategy selection in developing countries and project monitoring and evaluation (M&E).

These research projects are often carried out in joint collaboration with colleagues from higher education institutions in developing countries.

2. Education and Curricula Upgrading

The vision

Courses and activities are designed with the goal of preparing a professional who has broad-based knowledge in technical and scientific fields, and who is able to operate in the energy sector on a multi-scale level. Curricula are updated to give students the opportunity to engage with sustainable development issues using a holistic approach, analyzing international policies and legislation, understanding all interested actors co-operating on projects, and highlighting the interrelation among economic, social, environmental and technical dimensions. Indeed, courses encompass contents which go beyond the mere technical and engineering aspects. Indeed, these contents include other issues such as business models, the environmental

and social impact, and political and legislative frameworks.

Moreover, theory and practice are linked together, in order to enhance learning and acceptance by students. Courses are implemented with the direct contribution of other development actors – NGOs, for example – and with the presentation of real cases in which students are involved, with a participative approach, for their final project work.

The actions

As part of efforts to upgrade curricula offerings, the Chair has promoted a new track in 'Energy for Development' within the master of science programme in energy engineering at Politecnico di Milano. The track combines fundamental knowledge of engineering with a holistic approach to addressing global problems that accounts for the economic, environmental and social impact of technological solutions and sustainable energy strategies. In this track, the goal is to train professionals with a broad knowledge of technical and scientific fields, and who are able to operate in the energy sector at a multi-scale level by carrying out energy-scenario analyses and developing appropriate technologies. Within this MSc, the course 'Engineering and Cooperation for Development' (8 ECTS¹) has been delivered to introduce students to the topics of development and cooperation, as well as to the role of scientific research and technology in the field. It improves the academic background of future professionals with competences related to scientific research and innovation for global development. The course is designed to meet two educational goals. The first of these is to provide cognitive and methodological tools for cooperation and development in order to increase students' ability to successfully meet the social challenges that affect critical economies in particular. The second of the goals is to couple the engineering vision with the set of human factors and ethical principles – the ones that are necessary for developing the instruments and values to generate innovation and development across different contexts. The courses allow students to learn methodological approaches for technology-related co-operation projects, inspired by the criteria of sustainability. They address in detail

the following topics: context analysis; participatory and sustainable tool design; appropriate energy and resource management technologies; financial mechanisms and evaluation models for technical cooperation projects; human rights and ethics; and resource distribution and equity.

The Chair is also responsible for the course in 'Energy for Sustainable Development' (6 ECTS) within the Master of Science in Environmental and Geomatic Engineering programme in Como. Furthermore, the Chair has organized a PhD Summer School for engineers, architects and designers, in collaboration with UNIDO, and with the support of Fondazione Cariplo. The course has seen the participation of 19 PhD candidates, from several different nationalities and disciplines, in multi-disciplinary topics. These have included: access to energy and sustainable development; interrelationships among energy, the environment and social questions; appropriate technologies; energy strategies in developing countries; and the links between energy, the economy and policy-making. With the support of international experts, students work on real case studies involving project work. The Chair also promotes capacity building and staff upgrading among PhD candidates coming from universities in developing countries. In 2014, five PhD candidates are following this track while retaining their position in their home university so that their PhD degree will contribute to local staff upgrading, thus limiting the potential risk of brain drain.

3. Enforcing Networking for Technical Cooperation and Community Service

The vision

The focus on sustainable development also meets the growing interest of Politecnico di Milano in sharing this mission with other institutions that share this goal. 'Horizontal' partnerships among universities may represent a form of 'scientific diplomacy'. This can enhance the establishment of strategic relations, with the goal of developing local networks and contributing to the capacity-building process. 'Transversal' partnerships with other actors may support interaction within the context of intervention. While civil society

¹ European Credit and Accumulation Transfer System

and NGOs have a deep and direct knowledge of the local community, the public sector is often in charge of the management and control of local resources and services. Meanwhile, the private sector may initiate effective actions of technological cooperation.

The actions

One of the strategic goals of the Chair is to foster international university partnerships with developing and emerging countries, supporting capacity-building processes and upgrading higher education institutions (HEIs) in target countries. Three project proposals have received grants from the European Commission and are now being implemented: two in Egypt under the TEMPUS programme, and one in Kenya, Tanzania and Ethiopia, under the EDULINK programme. These three projects aim to upgrade local higher education systems with regard to their sustainable development and sustainable energy strategies. They also aim to promote North-South and South-South cooperation.

The first Tempus project, 'GIEP – Green Innovation and Entrepreneurship Programme', has as its overall objective the creation of a new generation of business and social entrepreneurs with the right skills to start up green businesses, launch innovative ventures and products, and put in place public policy and social innovation. New Master of Science programmes on these topics are being developed in five Egyptian universities with the support of European partners. 'TRINEX – Knowledge Triangle Platform for the Water-Energy-Food Nexus' is the second Tempus project, whose overall objective is to make the water, energy and food nexus (WEF Nexus) the next research, education and innovation frontier for sustainable resource management and development within the framework of the green economy in Egypt. The project aims at improving the role of universities in Egyptian society by developing a national strategy and a university platform to address the WEF nexus as well as supporting the qualification of PhD students.

'ENERGISE – Enlarged Network in Education and Research for a Growing Impact of Sustainable Energy Engineering on Local Development' in the Edulink programme has the objective of developing high quality, market-driven curricula in energy engineering that focus on sustainability, innovative technologies, and

modern renewable energies relevant to energy assets in Ethiopia, Kenya and Tanzania. The project involves four local universities, and relies on the collaboration of local businesses, NGOs, ministerial departments, and rural agencies, working at different levels on access to energy.

The Chair also conducts advisory activities and joint projects with NGOs and private companies active in the energy sector at the national and international level. In this technological cooperation, the role of the Chair focuses on research and is oriented towards capacity-building, innovative solutions, and methodologies for promoting the introduction of sustainable-energy technologies.

UN Global Action Programme and further steps

The Global Action Programme (GAP) on DESD will create an institutionalized process that generates and scales up DESD action after 31 December 2014 through a follow-up programme. It is intended to make a substantial contribution to the post-2015 agenda, in order 'to generate and continue the actions in all levels and areas of education and learning to accelerate progress towards sustainable development' (UNESCO, 2013). To enable strategic focus and stakeholder commitment, the GAP draft focuses on five priority action areas: advancing policy; integrating sustainability practices into education and training environments; increasing the capacity of educators and trainers; empowering and mobilizing youth; and encouraging local communities and municipal authorities to develop community-based ESD programmes.

This effort is even more important since the current demand of society for sustainable growth – and therefore for a more equitable distribution of energy, water and food – represents today an enormous challenge that cannot be overcome without the proactive role of academia. Indeed, at the global level a number of international initiatives have been launched to activate the scientific community. For instance, the United Nations Sustainable Development Solutions Network (SDSN) launched by the UN Secretary-General in 2012 recognizes the key role played by science and education. SDSN aims at accelerating joint learning, and

at helping to overcome the compartmentalization of technical and political work by promoting integrated approaches to the economic, social, and environmental challenges facing the whole world. To this end, Politecnico di Milano is now a member of UN SDNS and is also an affiliate of the MED Solution. The latter is an internal network of UN SDNS, with a focus on the Mediterranean region.

Moreover, the Chair is organizing a number of events and actions aiming at increasing the policy support which can be provided by academia and for the Chair to be a multidisciplinary hub for promoting innovative and successful solutions within public-private partnerships. Along the same lines, the completion of the two projects related to curricula upgrading in the Mediterranean region and in East Africa could represent an interesting pilot experience for the process of curricula harmonization. By supporting the implementation of labour-driven curricula relevant to the needs of developing and emerging countries, the promotion of regional accreditation and mobility may contribute to integrating sustainability practices into different education and training environments. To this end, in accordance with the aim expressed in the five GAP priorities, the Chair is planning a cooperation programme with one of the partner institutions in Sub-Saharan Africa in order to establish a centre of excellence for PhD training and professionals in the field of sustainable energy and efficiency. The idea is to contribute to an increase in the visibility and impact of African higher education institutions in the quest for more equitable and autonomous development.

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Human Rights Education and Education for Sustainable Development:

A Perspective for Cooperation

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The Chair on Human Rights Education

In Germany the UN Decade of Education for Sustainable Development proved its potential for disseminating and implementing the concepts and practices of ESD (Rode and Michelsen, 2012). The UN Decade consisted of a series of initiatives with increasing numbers of participants and projects. All educational sectors were involved, research areas were developed, and the media coverage was remarkable. For example, the homepage of the coordinating Federal Ministry for Education and Research reads:

On behalf of, and supported by, the BMBF (Federal Ministry for Education and Research), the German National Commission for UNESCO has taken on the role of coordinator. It has appointed a National Committee, through which it contributes to the coordination of the political players and the involvement of civil society. ... The National Committee has drafted the National Action Plan to implement the UN Decade in Germany. The Federal Government, the Länder, local districts, educational institutions, NGOs, businesses, civil-society networks, and individuals are all working together to strengthen education for sustainable development. Each year, 130 important organizations and institutions meet at the UN Decade's Round Table, where they plan the next steps to advance education for sustainable development in Germany. Together with UNESCO, and in cooperation with the German UNESCO

Commission, the BMBF organized the UNESCO World Conference for Education for Sustainable Development in Bonn in spring 2009. Over 900 representatives from 150 UNESCO Member States participated... Participants reached a unanimous agreement on the Bonn Declaration, which calls for a new orientation of education systems across the world.

The Chair in Human Rights Education (HRE) is well established at the Otto-von-Guericke University of Magdeburg. The objective of the Chair is to promote an integrated system of research, training, information and documentation activities in the field of human rights education at local and regional level. The Chair aims to contribute to the development of a culture of human rights. In cooperation with the Chair of Social Philosophy, the Chair founded the Centre of Human Rights at the University.

The specialized courses of the Chair are a (compulsory) pillar of the Master's programme in peace and conflict research. The general courses are open for all students, and there are large numbers of international students now attending the courses. The Chair cooperates with universities both in Germany and abroad, as well as with human rights networks in civil society. Due to activities of the assistant professor, who strongly supports the work of the Chair, international co-operation programmes in the Asian region were developed.

There are two new core research topics of the Chair: a theory of the culture of human rights, and the relationship between human rights education and ESD. Within the overlapping frameworks of the World Programme for Human Rights Education and the UN Decade of Education for Sustainable Development (ESD), the Chair has begun to inquire into the commonalities and differences between HRE and ESD.

Research and teaching on ESD and HRE

In response to the growing visibility and impact of ESD, the Chair in Human Rights Education started researching and teaching topics in ESD. Challenged by a perceived political and educational competition between ESD and HRE, the Chair of Human Rights Education at the Otto-von Guericke-University of Magdeburg started developing courses on the relationship between human rights and sustainable development, and integrating them into the Master's programmes of the Faculty of Human Sciences.

An additional innovative element of the embedding of sustainable development and ESD in courses at the University of Magdeburg is as a result of cooperation between the UNESCO Chair and the Virtual Academy of Sustainability, which is coordinated by the University of Bremen. The Academy supports German higher education institutions by offering video-based courses that are designed so that they are useable for optional courses, general studies, open studies or specialization modules and certificates. The validity check can be completed in any higher education institution. Being a virtual academy means that students can take part in video-based courses offering fundamentals of ESD even if they haven't any prior knowledge. Via distance learning, by means of video-based courses, they will acquire levels of proficiency in knowledge and understanding.

The Virtual Academy fosters education that enables people to foresee, face up to, and solve the problems that threaten life on our planet. It also exemplifies

education that disseminates the values and principles that are the basis of sustainable development: intergenerational equity; gender parity; social tolerance; poverty reduction; environmental protection and restoration; natural resource conservation; and just and peaceful societies. Lastly, it means education that highlights the complexity and interdependence of three spheres: the environment; society (broadly defined to include culture); and the economy¹

Ten lessons could be drawn concerning the interdisciplinary courses:

- After decades of separate policy development, there have been mutual efforts by academics and policy-makers to achieve rapprochement between two key concepts of global moral discourse: human rights and sustainable development. The guiding question is: what do these two key concepts have in common, and how do they differ?
- At first glance, the differences between sustainable development (SD) and human rights are remarkable. Human rights and sustainable development have different roots, and have emerged to protect against very different threats. Human rights involve protecting people against domination and discrimination. Sustainable development is meant to protect nature and the environment against the consequences of an ongoing global ecological crisis. While human rights focus on the vulnerability of individual human beings, the focus of sustainable development is on the vulnerability of the environment. Human rights involve human entitlement and self-determination; sustainable development calls for human responsibility and self-restraint. Sustainable development, in the words of the Brundtland Report, pledges 'to meet the needs of the present without compromising the ability of future generations to meet their own needs'. Human rights are predominantly interested in present needs.
- A critical view reveals, however, that sustainable development is a more complex response to the challenges of our time. A reconstruction of how the concept of sustainable development was developed

¹ See <http://www.va-bne.de/>

shows how developmental and environmental issues and concerns were merged and integrated. The recognition of the interconnectedness of global crises led to the academic and political construction of an integrated strategy that combines the formerly separated politics of environment and development, by striving to integrate the demands for intra- and inter-generational justice.

- Further analysis shows how the concept of sustainable development has been expanded over the years. In the mainstream interpretation, the 'house of sustainable development' consists of three pillars: ecological, social, and economic. The addition of a fourth pillar, of cultural sustainability, has also been widely discussed. This integration of social and economic issues into the concept of sustainable development reveals the linkage to human rights.
- In a next step it is possible to show that human rights have evolved, with today's 'house of human rights' consisting of three dimensions (corresponding to three successive generations), each protecting different aspects of human vulnerability. The first dimension consists of political and civil rights, the second covers economic, social and cultural rights, and the third, solidarity rights, which include the right to a clean environment. Particularly between the social and economic pillars of sustainable development, and social, economic, and cultural human rights, there are themes and commonalities that overlap considerably.
- Both the human rights and the sustainable development discourses share a common feature, namely, the three pillars of sustainable development as well as the three dimensions of human rights remain controversial. Further research is needed, therefore, in order to find out which aspects of human rights, and of sustainable development, have been pursued by which actors, and with which preferences.
- The next lesson learned shows that companies are now recognized as important stakeholders of human rights protection and sustainable development. In human rights discourse, companies are increasingly seen as key actors, whose actions can serve to protect or violate human rights. Different models of corporate social responsibility (CSR) and commitment are being discussed, and at least partially implemented. Also, there are proposals to develop binding human rights obligations for companies. Furthermore, similar corporate responsibility guidelines for sustainable development have been elaborated.
- In a next step, the different perspectives of a 'rapprochement' between human rights and sustainable development are addressed:
 - The development of a human right to sustainable development.
 - An integrative concept of human development that focuses on reducing human vulnerabilities, and on sustainable human progress.
 - A human-rights based approach to development that requires adherence to principles such as participation, accountability, equality, and non-discrimination. In addition, human development goals are to be understood as entitlements of rights holders, and not simply as human needs or requirements for development. Such entitlements can be claimed against the corresponding duty holders, such as the state or the international development community.
- Finally it can be argued that education is indispensable for the implementation of both human rights and sustainable development. Human rights that are unknown, or misunderstood, remain rights without an impact. Even if we all understand their meanings well enough, if nobody is willing to respect, implement, and protect them, they remain an empty promise. Hence, human rights education must enable not only learning about human rights, but learning how to enforce them. The task for education for sustainable development is even more challenging. It has to prepare a solid basis for the institutionalization of sustainable development, as it is not yet anchored in international and regional agreements, as human rights are.
- In order to strengthen the impacts of HRE and ESD, educators in both fields should start exchanging ideas and experiences, learning from each other, and supporting each other in their endeavours.

Lessons learned

In light of these ten lessons learned, we now put forward ten theses that could pave the way to more fruitful cooperation between HRE and ESD:

- While there are many overlapping issues and common interests between human rights and sustainable development, there are also noticeable differences. At the same time, from the perspective of the concept of human development, these differences do not seem to be unbridgeable.
- Both educational approaches are based on the values, principles and practices that are necessary to respond effectively to current and future challenges. They share some of the main underpinning values like justice, equity, inclusion and responsibility, and they share the task of imparting such values without indoctrination.
- Both approaches are umbrella concepts. ESD is made up of environmental education and development education, just as sustainable development consists of development and environmental issues. Likewise, HRE has evolved into a more or less integrated concept of HRE/EDC, at least within the framework of the educational policy of the Council of Europe. Hence, ESD and HRE should learn to profit from the advantages of such diversity within their approaches, instead of competing against each other. This would then show that the diversity within ESD and HRE may lead to cooperation. There are already traditional approaches within ESD – namely, those of development education and global learning – that are strongly interconnected with HRE.
- Both approaches seek to address a heterogeneous, and sometimes antagonistic, audience: those who are vulnerable, or victims, as well as those who are responsible, or even the perpetrators of an injustice; the rights holder as well as the duty bearer, the producer as well as the consumer.
- Both approaches aim at changing the mind-sets of companies. HRE and ESD face the challenge of imparting, to corporate actors, an interest in implementing corporate policies oriented towards human rights and sustainability.
- Both HRE and ESD critically focus on change. Therefore, they can develop competencies for the empowerment of the vulnerable as a means of controlling the power of potential violators. This aspect of the critique of power has often been underestimated. Instead of fragmented efforts, and uncoordinated problem solving, a holistic, transformative approach to education is therefore needed, to tackle human rights violations and non-sustainable development.
- Both approaches are poised to challenge the mainstream neoliberal knowledge system, and the attitudes and behaviour of the ignorant, the indifferent and the irresponsible. Educators strive then to promote changes in mind-sets, lifestyles and ways of life. Such aspirations go beyond affecting the lives of individuals. They reach out to challenge the mind-sets and behaviours prevalent in society. This effort can be best labelled as a process of creating a new integrated culture – a ‘culture of human rights and sustainability’.
- Both approaches require solid research efforts based on information about the ‘dark sides’ of societies: about the deep-rootedness of cultures of dominance, of violence, and the blind convictions behind unrestricted economic growth and consumption. Each of us can be affected by these cultures. Only on the basis of reliable research findings can educators avoid the risks of developing inappropriate approaches to ESD and HRE.
- ESD and HRE may be tempted to set expectations too high and, as a result, fall short. The sought-after changes cannot be achieved by education alone. Education is only one essential part of the global response to the crises of human rights and sustainability. Political will, consideration of economic interest, a commitment on the part of civil society, and support from the media, are also indispensable for successful change.
- ESD and HRE are elaborated, supported and demanded by state and non-state actors at various levels (including international organizations, national governments, and civil society actors). But at the end of the day, the results of educational work in both fields are, first and foremost, the results of interactions between educators and learners. Therefore, educating educators – at all levels – remains one of the most urgent tasks for HRE and for the Global Action Programme on ESD.

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III. Education for

Sustainable Development

and the UNESCO Chairs:

Institutional Level

Initiatives

A Paradigm Shift in Higher Education

Teaching and Learning:

Practices Towards Education for Sustainability

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1 Introduction

The sustainability revolution is, as Edwards (2005) points out, and like the industrial revolution before it, creating a pervasive and permanent shift in consciousness and worldview that is affecting all facets of society. However, it has taken a long time to realize that the paradigm of unsustainable development has to be radically changed towards a more sustainable one. It is also now being recognized that, in order to move towards a sustainable path to development, there is a need to change the old sustainable development mindset to embrace a new awareness of the ethics and values of the sustainable development paradigm (Burns, 2012). What has also been recognized is that, for this to happen, we need people who are able to transform both themselves and society. As education at all levels, especially higher education, is also responsible for the sustainability crisis (Makrakis, 2011), it is not only the paradigm of development that needs to be changed, but also that of education. Indeed, 'the great challenge of the 21st century for institutions of higher learning is to help them function as agents of change' (Makrakis, 2014).

A question that challenges academics and policy-makers in education is deciding upon the sort of teaching and learning that students will need to meet the profound social, environmental, economic and political challenges of the 21st century? Indeed, this critical question for higher education was reflected in the decision of the United Nations to declare the Decade of Education for Sustainable Development (UNDESD 2005-2014). The UN's DESD highlighted the

critical role of education at all levels as a driver behind the transformation of society from an unsustainable, to a sustainable, path of development.

In support of the UN Decade, the Hellenic Republic decided to incorporate education for sustainable development (ESD) into formal education in all relevant subjects, as well as into non-formal education. Besides integrating ESD into new curricula, a new subject has also been introduced in the first year of senior-high school, called geology and natural resources management. The Institute of Educational Policy (IEP) has also developed an autonomous curriculum for ESD addressed to all levels of compulsory education. According to recent data, 9,784 ESD projects were developed, with 19,024 teachers and 235,368 students. Additionally, 439 seminars were organized for teachers as well as for the local community. In post-compulsory education, new legislation in 2013 provides for the integration of sustainable development objectives into the curriculum; for vocational senior-high school, it is environment and natural resources that is integrated into the curriculum.

The 51 Centres for Environmental Education and Sustainability (CEES), spread across Greece, and staffed by primary and secondary school teachers, have contributed significantly to the implementation of ESD in primary and secondary schools. The CEES provide capacity-building to teachers, produce ESD-related teaching materials, and organize learning events. During the 2012-13 school year, 82,805 students visited the CEES (48,017 from primary schools, and 4,788 from secondary schools (Greece-DESD). The

Hellenic Republic recognizes education for sustainable development (ESD) as a powerful tool for achieving both sustainable development and peace and stability within and among countries. At the level of higher education in Greece, a notable initiative is the Charter of Greek Universities for Sustainable Development (CGUSD), which was drafted, approved and signed by the Session of Rectors. The CGUSD embraces the principles of sustainable development as enshrined in international treaties and conventions, and is committed to promoting the integration of sustainable development in the Greek universities.

2 The contribution of the UNESCO Chair on ICT (Information and Computer Technology) in ESD

The UNESCO Chair on ICT in Education for Sustainable Development, established at the University of Crete in 2008, has been very active in promoting ESD at local, national and international levels. It has initiated the establishment of the Regional Centre of Expertise, Crete, which has received the acknowledgement of both the United Nations University, and the Earth Charter Hellas. The Chair has also led the integration of ESD into various courses of the teacher education programme at the University of Crete (Kostoulas-Makrakis and Makrakis, 2012). More specifically, ESD was integrated into more than five courses. A new compulsory undergraduate course entitled 'ICT in Education for Sustainable Development', and also an elective course entitled 'Didactics and Education for Sustainable Development', were introduced. It is also worth pointing out that the title of an academic position on teaching methodology was changed to include an emphasis on ESD. In the new Master's degree programme in education, the Chair initiated the development of an ESD track, with specializations in: 1) the theory of teaching and curricula oriented towards sustainable development; 2) ICTs in education for sustainable development; and 3) educational evaluation with an emphasis on sustainable development. Similarly, the Chair consulted the vice-rector of academic affairs in the development of the university's policy on the issue of sustainability, suggesting measures for turning the University of Crete into a Sustainable University.

The Chair has also taken initiatives to establish a North-South network of university institutions to promote ESD. Over the past few years, the Chair has prepared three project applications, and has invited members of the network to join. The first project, called 'Reorient University Curricula to Address Sustainability' (RUCAS), and funded by the European Commission Tempus programme project, brought together 12 universities from the European Union and the Middle East to reorient university curricula in order to address sustainability. This project has received a recognition award from the United Nations University for its contribution to reorienting learning approaches towards sustainability in institutions of higher education. Another project coordinated by the Chair, the ICT-enabled Education for Sustainable Development, also funded by the European Commission, resulted in the development of a Master of Science programme on ICT in education for sustainable development (Makrakis and Kostoulas-Makrakis, 2012; Kostoulas-Makrakis, 2014), which is being implemented by Frederick University of Cyprus, under the coordination of the Chairholder, Prof. Dr. Vassilios Makrakis (MSc. ICT in ESD, 2014). A recent project entitled CLIMASP is a programme, funded by European Commission TEMPUS, that aims to develop inter-disciplinary programmes in climate change and sustainability policy for undergraduate students across 10 universities in Egypt, Jordan and Lebanon, and is coordinated by the University of Crete. As pointed out earlier, a paradigm shift in teaching and learning for sustainability is needed if we aspire for higher education institutions to play a critical role in building a more sustainable future.

3 Paradigm shifts: setting the stage for transforming teaching and learning towards sustainability

The results of the RUCAS survey (with the participation of 3,570 students in 11 partner universities) revealed that lecturing was the most commonly practiced teaching/learning method (62%), while other methods more suitable to ESD pedagogy, such as place-based learning (15%), inquiry-based learning (16%), problem-based learning (17%), discovery learning (16%) and inter-disciplinary teaching (20%), lagged far behind

(Makrakis and Kostoulas-Makrakis, 2013). What is needed, therefore, is a shift to alternative teaching and learning paradigms that are more suitable to education for sustainable development.

Embedding sustainability into university curricula necessitates a context of learning that serves as an alternative to instructivist and instructor-centred learning and teaching approaches. This implies a shift from instructivist to constructivist and post-constructivist paradigms in teaching and learning design. The basic assumptions of the instructivist, constructivist and post-constructivist continuum are summarized in Table 1 (Jonassen, 1991; Feng, 1996). Despite differences, especially at the ontological, epistemological and axiological level, both instructivism and constructivism can be viewed as complementary positions on a continuum of learning strategies.

The RUCAS project was designed to explore the contexts and conditions needed for its partners to experience the kind of on-the-job, transformational learning they need if they are to meet the needs of 21st century learners. Its focus is on experience, construction and transformation.

The ExConTra learning paradigm embraces educational approaches such as inquiry and discovery-based learning, service learning, place-based learning, and reflective/reflexive learning. All of these approaches are associated with teaching methods and strategies that are suitable to the ESD paradigm. The ExConTra learning paradigm is also associated with the key learning processes depicted in Table 2. These learning processes were assessed during the implementation of the student practicum placements (similar to internships) in the partner country universities in Egypt, Jordan and Lebanon.

Table 1: Basic assumptions of instructivist, constructivist and post-constructivist learning paradigms

Basic Assumptions	Instructivism	Constructivism	Post-constructivism
Assumptions about reality (ontology)	One known reality with some probability; External to the knower	Multiple, socially-constructed realities	Multiple realities shaped by social, political, socio-cultural values
Assumptions about knowledge (epistemology/ human interests)	Objectivity must be reproducible; Technical	Knowledge arises through a process of active construction; Inter-subjective; Practical	Rejections of fixed notions of reality, knowledge or methods; Knowledge may be a human construct, but an objective reality does exist; Emancipatory
Stance toward values	Neutral (dichotomy between value and fact)	Part of the experience	No dichotomy between facts and values
Assumptions about learning	Reproduce subject content; Learning result is indicative of a behavioural changes	Learning is seen as the construction of meaning; Learning through reflection; Real-world settings	Learning is more than the construction of meaning by learners; it is the process by which learners are integrated into a knowledge community

Source: Authors

Basic Assumptions	Instructivism	Constructivism	Post-constructivism
Assumptions about teaching	The instructor is the primary source of knowledge (instructor-centred); Emphasis on how we teach (transfer of content)	Focus on the facilitation of learning according to the needs and potentials of learners (learner-centred)	Emphasis on self-directed learning enabled by multiple sources and teaching facilitation
Assumptions about curriculum	Content-driven and product oriented Vertical External Technical	Process-oriented Horizontal Negotiated Practical	Process/praxis-driven Critical/ empowerment Open-ended Critical/ emancipatory

Source: Authors

Table 2: Description of the key ESD-related learning processes

Key ESD Learning Processes	Description
Asking critical questions	A process that challenges learners to examine the way they interpret the world and how the knowledge and opinions of people are shaped.
Values clarification	A process engaging the learner in clarifying (and often reconstructing) a value base to inform thinking and actions which influence sustainable development.
Systems thinking	A process that recognizes that everything interacts with (affects and is affected by) the things around it.
Critical and reflective thinking	A process involving a deep examination of the root causes of unsustainability and engaging learners in recognizing both bias, and the assumptions underlying their own knowledge, perspectives and opinions.
Futures thinking	A process of learning to envision more positive and sustainable futures; it is a process which transforms the way people relate to their future, helping to cultivate dreams, inspire hope, and lead to action plans for a more sustainable future.
Transformative and participatory learning	A process of 'perspective transformation', with three dimensions: psychological (changes in understanding of the self), convictional (revision of belief systems), and behavioural (changes in lifestyle).

Source: Authors

4 Transforming teaching and learning practices

The RUCAS student practicum placements were targeted at six universities in the partner countries of Egypt, Jordan and Lebanon. These placements allow students to blend theory learned in the classroom with hands-on practical experience. It is a requirement for undergraduates to do their practicum, which is similar

to an internship, as a period of supervised educational work experience with an approved agency, organization, or institution. Following completion of the practicum, each course instructor was asked to choose up to five assignments that were considered as 'good practice'. There were 127 practicum assignments submitted from 42 revised courses representing six prioritized disciplines: educational sciences, social sciences, applied sciences, economics and business sciences, technical

sciences, and health sciences. The assessment of the reported good practices was based on a semi-structured questionnaire, which was answered by the university instructors whose courses were involved in the student practicum placements.

A total of 1861 students participated in a practicum during the fall semester of the 2012-13 academic year. Among them, 904 students were from Jordan (644 from Hashemite University and 260 from the

University of Jordan); 674 from Egypt (654 from Suez Canal University and 20 from Heliopolis University); and, finally, 283 students from Lebanon (188 from La Sagesse University and 95 from Notre Dame University). The practicum assignments varied according to the course and discipline. In general, almost all of the topics of the practicum assignments were contextualized in the local environment. Indicative examples of practicum assignments carried out, and their contexts, are shown in Table 3.

Table 3. Examples of practicum assignments and placements

Practicum assignments	Practicum placements
Groundwater pollution and its impacts on development in Lebanon; Child labor; Sports; Air pollution; Migratory birds; Cultivation of warm-season vegetable crops by seeds and seedlings; Preparation and packaging of vegetable crops and products for exportation; Regional water disputes; Water security and sustainability; Fair trade and sustainability.	Ministry of Agriculture (Lebanon); Cenacle Libanais pour la protection de l'environnement; Ministry of Energy and Water Resources (Lebanon); Ministry of the Economy (Lebanon); Ministry of Youth and Sports (Lebanon); Fédération Libanaise du Basketball; Sustainable practices in the Shouf Cedar Reserve; Ministry of the Environment (Lebanon); Lebanese Industrial and Commercial Associations; Ministry of Energy and Water Resources.

Source: Authors

With regard to the practicum topics, 37 topics were initially included in the data collection instrument, which was supplemented by 11 more topics provided by respondents. Of the total 48 topics, the most widely included in the courses was the environment (26 courses). Then came ethics (18 courses); pollution (17 courses); health, sustainable production and consumption (11 courses); the economy (10 courses); and water, biodiversity and gender (total of 9 courses). HIV/AIDS, multiculturalism, and indigenous knowledge, were not included. The teaching and learning processes most frequently used were: values clarification; critical/reflective thinking; systemic thinking; futures-thinking; transformative and participatory learning; and critical questioning. The following anecdotal reflections represent the majority of those who submitted their good practices. The first of these reads:

The analysis of the teaching and learning activities I am currently using includes different forms, such as lecturing, project-based learning, case-based instruction and interdisciplinary learning.

The second reads as follows:

My teaching methods are now very diversified: I use project-based learning, which is crucial to address complex SD topics as it is a student-centred experiential learning approach by nature ... Many times I use case-based instruction, which is an active, learner-centred model that is used to facilitate the development of reasoning skills, and to connect classroom teaching to real world scenarios.

While interdisciplinary teaching was very rarely used as a practice before the RUCAS intervention, through its capacity-building program, the good practices show a shift from mono-disciplinary teaching to interdisciplinary teaching and learning. The teaching methods adopted include place-based learning and teaching, service learning, and discovery learning. Similarly, the impact of capacity-building workshops seems to have made a significant contribution to the transformation of teaching practices by instructors. An instructor stated that:

Through attending the three training workshops, I learned how to state the course goals and objectives clearly, and to address the five pillars of sustainability competences and themes in the course materials, and how to integrate certain sustainability issues in different subject areas. Furthermore, I learned how to apply various pedagogical strategies, e.g.: group-work, self-reflection, peer discussions on global real-life topics or controversial issues, and to employ alternative means of assessment, such as performance tasks, data gathering assignments, research projects, oral presentations and portfolios. Discussing, reflecting, and peer-reviewing the course syllabi that I developed with the team members during the workshops before and after implementing the courses during the spring semester were very helpful.

Another one stated that:

At the beginning, I didn't know how I could incorporate ESD in my courses. This is because it is pure science. And I had fears that it would have a negative impact on the content and quality. In the first ESD workshop, some of my colleagues had the same concerns too. However, after attending a few lectures from experts, I started to realize the importance of ESD and started, with different colleagues, to think differently to be able to integrate ESD. After the first workshop, I decided to give it a try, but was not sure if I am doing the correct thing. In the second workshop, I have attended more lectures, and participated in many one-to-one and group discussions. But the most effect was from listening to colleagues' experience

and the challenges that they have met and the ways that they have used to overcome these challenges. Then I started to discover so many ways in which I can integrate ESD in my science course without affecting the content or the quality. After implementing the first course, I witnessed a greater change from the student side, and they expressed in many ways that they really like this new way of teaching the course and it becomes more and more interesting.

The training workshops that were held under RUCAS workshops demonstrated to participants that sustainability can be integrated into any course, even into courses that are considered more demanding such as business, economics, or mathematical courses. The revision and implementation of the new syllabus was a very important exercise for participants to go through. It also helped them to incorporate the principles of sustainability into every subject they are teaching. As one participant pointed out:

I am noticing a more defined way to teach students how to link the different facets of their lives, whether social, economic or scientific, together. Students became more enthusiastic about the material taught in class as they relate it to their own lives. Many of them sent me emails by the end of the course telling me that they learned a lot in the course, and they were introduced to new concepts that they never learned during their three years of Bachelor's degree.

Indeed, the major impact of integrating the concept of sustainability into teaching is that the students became an integral part of the learning process. The content materials and student-led activities related to their everyday life. One participant expressed this in the following words:

The workshops I attended in Lebanon, Egypt and Jordan were eye-opening for me. At first, the idea of introducing the concepts of sustainability was alien and bizarre for me. However, the idea became clearer after attending the workshops. The most pivotal was the revision and implementation of the new syllabus that incorporates the principles of sustainability. This made me think hard to find new

ways to explain scientific concepts and relate their implementation in areas related to social, economic and environmental sustainability. Compared with the old way of teaching my courses, I saw a clear change in the students in that they are more eager to learn because of the links shown between what is discussed in class, and their lives and how to live sustainably.

The course revision helped university staff participants to become more aware of how important it is to devise practical activities to promote the learning process, instead of just lecturing about issues and practices.

This experience gave staff the opportunity to undertake critical transformations. Moreover, it gave students a chance to utilize their theoretical knowledge and skills in the ‘real world’ by dealing with a total of 48 sustainability topics integrated into their practicum assignments. These results show a considerable

transformation compared to the initial results from the student survey (with 3570 students from our partner institutions), which indicated that most teaching (62%) was based on lecturing, and less than 20% on the ESD-related teaching methods. This situation has now been reversed, as all participating university instructors use a variety of teaching methods, integrating ESD-related teaching methods and learning processes into lecturing. These transformations also show that the RUCAS project responded to clear student preference for a transformative role that sees a university as an agent of change towards a fairer society and a better world. Introducing a number of key contextualised topics, concepts and activities related to the sustainability crisis, such as risk and globalization/environmental risks, environmental inequality, regional water disputes, water security and sustainability, regional water treaties and water-resources sustainability, and agriculture and sustainable development, was of critical importance for transforming staff teaching and learning practices.

Table 4: Recent and current activities of the UNESCO Chair ICT in ESD Programme on ESD

GAP priority action areas	Target/Activity	Duration	Resources
Advancing policy	Developing interdisciplinary minors on climate change and sustainability policy in 10 higher education institutions	2014-2016	EU-Tempus funded project http://www.climasp.edc.uoc.gr
Transforming the learning and training environment	Turning the University of Crete into a sustainable institution; RUCAS-Sustainable Universities Network	2014-2015 Since 2011	http://www.rucas.edc.uoc.gr
Building capacity of educators and trainers	RUCAS online professional development to ESD; CLIMASP training workshops	Since 2011	EU-Tempus funded projects http://www.rucastoolkit.eu http://www.climasp.edc.uoc.gr
Empowering and mobilizing youth	Developing video-clips and digital storytelling dealing with sustainability issues; Act for Climate: A web-based environment.	Since 2012	RCE Crete YouTube
Developing community-based ESD programmes	Service learning projects focusing on environmental, social, economic and cultural issues on the island of Crete.	Since 2012	Integrated into the pre-service teacher education and student practicum in community schools and civic societies.

Source: Authors

5 Further actions of the UNESCO Chair on ICT in ESD

The contribution of the UNESCO Chair ICT in ESD at the University of Crete towards these transformations was critical. The Chair will continue its efforts, and utilize the know-how and good practices it has achieved, to help further the UN Global Action Programme (GAP) for Education for Sustainable Development (which began in 2015) across all its five priorities. Table 4 provides an overview of the Chair's continued and planned actions towards these goals.

6 Conclusion

A key goal of our capacity-building interventions was to generate a paradigm shift in those teaching staff involved in course revision and implementation, in order to address sustainability issues. Practicum experiences were provided to students participating in the revised courses in the three target countries of Egypt, Jordan and Lebanon, so that coursework and experience could be integrated for sustainability-competence development. In addition, this experience gave students a chance to utilize their theoretical knowledge and skills in the 'real world'. It also opened up opportunities to learn about current sustainability issues and approaches in the field, as well as helping students to critically assess their values and actions when enabled by new teaching/learning approaches. Through research, curriculum, and critical pedagogy, the RUCAS project aimed to prepare students to be critical practitioners and agents of change. As part of this preparation (and as a requirement for taking part in the RUCAS project) each student completed a field practicum placement integrated into their coursework. Most of the course materials discussed in class took into account the social, cultural, economic and environmental aspects in the students' locality.

The student practicum placement is a very interesting approach to raising awareness among students of their role in protecting the environment, and in promoting sustainable values and practices. Students become aware that their role is more than just to devise their own sustainability ethos, but also to motivate others to develop and adopt an alternative lifestyle. They also learn that joining hands with others is a good strategy for improving everyone's quality of life. Interdisciplinary

learning has also been used to approach the most critical current global challenges, including climate change, sustainability, energy, and public health. Such methods require cooperative learning, and are based on the principles of experiential, constructivist, and transformative learning paradigms. Integrating sustainable development concepts, principles, and values, and merging knowledge with practice enabled through critical pedagogy, helped to change the old paradigm of teaching/learning methods to a new paradigm conducive to sustainability ethics and values. It transformed courses taught by participating university staff from very theoretical, science-based discussions into lively discussions that touch upon the everyday experiences of their students and make it easier for them to relate what they learn in the classroom to real-life situations. The comparative advantage of implementing ESD through the new teaching/learning paradigm is that we are targeting the learner by taking into account their previous experiences and knowledge, discussing relevant and culturally appropriate content, and using an active-learning participatory model of teaching and learning.

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Research, Training, Cooperation and Information in the Framework of Higher Education for Sustainable Development:

A Systemic Approach

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Introduction

The first decade of the century was defined by an increase in, and exacerbation of, environmental problems. However, in tandem with this rise, an increase in environmental awareness within our societies has equally taken place; there are a larger number of people who are concerned about the present environmental situation, and who take decisions in accord with these concerns. There is also a growing volume of institutions and companies that include sustainability goals in their projects. This state of play would not have been possible without the theoretical and practical advances of education for sustainable development, which have facilitated a greater environmental awareness and training for many types of professionals.

Additionally, the proclamation, by the United Nations, of the Decade of Education for Sustainable Development (UNDESD) proved to be a decisive event. The UNESCO Chairs, in answer to this appeal, intensified their work in this direction, taking action not only directly within their academic scope, but also encouraging the values and principles of sustainability in the context of their societies. The most relevant aspects of this movement towards sustainability are described below in the concrete framework of Spanish society and of our UNESCO Chair on Environmental Education and Sustainable Development.

The first decade of the 21st century in the context of Spain

In Spain, education for sustainable development has been through a very positive evolution, supported by the UNDESD. In the past few years, higher education institutions have worked at different levels, but with common objectives in mind, including the progress made by the University Social Responsibility (USR) programmes, in which different Spanish universities (including UNED) participate. The first university in Spain that implemented the USR was the University of Cordoba in 1998. Today, it is a framework accepted by the public universities which agree to apply a set of principles and values, stated in their management philosophy, and in the practice of their basic functions: management, teaching, research and production, and also outreach, with a view to responding to the demands of stakeholders in their environment. The commitment of the USR was initiated by the National University of Distance Education (UNED), in 2008, with its 'Social Responsibility Program'.

The establishment of a higher number of training programmes in which sustainability is considered – either as a central focus or as a cross-curricular area to be covered – represents the most remarkable step forward. At university degree level, it can be observed how different universities have included subjects

with contents that are specific to sustainability. A very interesting change has come about; as recent research reveals, sustainability is now understood as a significant dimension in the coverage of the different university degree subjects pursued by students (Aznar Minguet et al., 2013; 2014).

At postgraduate level, there are specific specialized programmes addressed to a range of professionals, such as – among others – the Postgraduate Programme in Environmental Education and Sustainable Development, and the Master’s level course in Sustainability and Corporate Social Responsibility (UNED), or the Master’s level course in Environmental Education, in which several universities from Andalusia participate.

Some universities, such as the Autonomous University of Madrid (thanks to its Ecocampus Project) and the Autonomous University of Valencia (with its Campus Sostenible-UVEG Project) already build on

the incorporation of a consolidated Agenda 21¹. Both projects want to promote initiatives for sustainable development as a reflection of the universities’ level of commitment to Agenda 21. They seek to promote healthier living conditions, more responsible consumption and to raise the awareness of the university community about sustainability.

Regarding the creation of networks, it is important to mention the following institutions: the Autonomous Universities of Barcelona and Girona, which are members of the ACES network of Catalan universities; the EDUSOST network, devoted to research on education for sustainability; and the RIDIES network, which extends to more than a dozen public and private universities in Spain and which is geared to promoting curricular sustainability.

1 *Agenda 21* is a non-binding voluntarily implemented action plan of the United Nations with regard to sustainable development. (<https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf>)

Table 1. Sustainable Development Networks in Spain

Network		
ACES	Objective	Education for sustainability constitutes an objective which implies a focused educative force aimed at changing interpretive models in relation to environmental questions. Meanwhile, it also offers the chance to experience alternative (life) models, which in turn, will lead to analysis and advancement.
	Web	http://insma.udg.es/ambientalitzacio/web_alfastinas/portada.htm
EDUSOST		To promote and optimize the education for sustainability, creating knowledge from the experiences developed up to the current day, especially by the participating groups and from the exchange and collaboration in research, improvement and innovation projects.
	Web	http://www.edusost.cat/en/network-members/universities
RIDIES	Objective	Open, and set up, a workspace for sharing, debate, analysis, documentation and research in the field of the sustainability. Promote the development of exemplification, and support tools, for teaching. Promote the effectiveness of the results of research through its application among the members of the network research teams.
	Web	http://www.crue.org/Sostenibilidad/CADEP/Documents/fichas_co_nstucion/6.pdf

Source: Authors

However, the most significant movement is possibly that undertaken by the Conference of Chancellors of Spanish Universities (www.crue.org), through its Commission on Environmental Quality and Sustainable Development (CADEP). Over the past few years, this committee has been working to stimulate the inclusion of the sustainability dimension in higher education. Its members (amongst whom are lecturers from the UNED Chair) have established a number of competencies in sustainability that can be addressed in every area, namely:

- Competence in the critical contextualisation of knowledge, establishing relationships with social, economic and environmental problems, at local and/or global levels.
- Competence in the sustainable use of resources, and the prevention of negative impacts on the natural and social environments.
- Competence in the participation in community processes that promote sustainability.
- Competence in the application of ethical principles in relation to values of sustainability in both personal and professional fields.

From a research and dissemination point of view, there are numerous scientific publications (both books and papers) on this topic. Due to space constraints, in the following section, solely the publications produced by our UNESCO Chair will be listed. However, special mention is due to the important role played by the Organization of Ibero-American States, via its publications and its web site (www.oei.es/decada), to disseminate on UNDESD.

In the movement described above, our UNESCO Chair has played a relevant part, boosting a great number of activities and cooperating in different areas of research, training, information and communication. The UNESCO Chair has been represented at all the national biennial conferences on the environment (CONAMA), via a round table on sustainability issues. It has also participated in the organization of the conference on *Projects and Utopias for a Better World*, making contributions on

aspects related to sustainable development, to ethics in sustainability, and to a culture of peace with the planet.

The UNED UNESCO Chair team has participated in numerous conferences at academic, professional and social meetings, on disseminating the principles and values of sustainability. It has also joined forces with other universities, via networks, in order to work on the inclusion of Education for Sustainable Development (ESD) in university course programmes. Moreover, it has organized debates and seminars with professionals in civil-society groups that have stimulated awareness among journalists, project managers, and decision-makers, about the urgent need for a paradigm change towards sustainability.

The UNED Chair has become a point of reference, both in Spain and Latin America, when creating a theoretical corpus on ESD, and when applying the principles of ESD to the academic, political, and social realities of our societies. In order to cultivate this role, the UNED Chair has participated in the most important Spanish and Latin American events on this topic. In the following sections, the most noteworthy actions in this area are described in more detail.

The UNESCO Chair on Environmental Education and Sustainable Development was established in 1996, via an agreement signed by the UNESCO General Director and the Vice-Chancellor at (National University of Distance Education (UNES). This agreement states the 'establishment of an integrated research, training, information and documentation system' as its objective – initially in environmental education, and subsequently extended to sustainable development.

The Chair is led by Professor María Novo, PhD, and consists of a team of two permanent lecturers and a scholarship researcher, who assists with management tasks. The University supplies the necessary resources to maintain this team of staff, and to cover the infrastructure and travelling expenses for attending national and international events. The UNED also covers organizational costs for the international Postgraduate Programme,

and the maintenance of the network of higher education degree-holders in environmental education and sustainable development. At present, the UNED is funding a research project regarding the inclusion of sustainability in degree course programmes, directed and managed via the UNESCO Chair.

The Chair has its own website and a mailing list of 5,000, which is a compilation of the data and addresses of the most relevant people, institutions and organizations in relation to ESD, both in Spain, and internationally.

The philosophy and expert areas of the UNED Chair

Our UNESCO Chair programmes and educational projects adopt a systemic-complex approach, working in a cross-disciplinary manner on multiple elements and scientific, social, economic, environmental, and educational areas. The reasoning behind this approach is that the complexity of the environmental systems, together with the problems that the planet and humanity are presently experiencing, demand an integrated approach that embraces the interactions between different stakeholders, elements and contexts.

The UNESCO Chair programmes are targeted in particular at the training of 'key people', with a view to optimizing the results of our teaching efforts. Addressing our teaching towards professionals responsible for training, managing and decision-making, generates a multiplying effect. This leads to a true qualitative 'leap', owing to the repercussions that attitudinal changes on the part of these key professionals have on the activities for which they are responsible. Additionally, when UNED students also happen to be university lecturers, the effect is instant, as they promptly incorporate the newly learned content into their own teaching. This means that the acquired knowledge and competence in sustainability reaches a wide population group, with a high degree of social relevance.

The UNESCO Chair works to incorporate subjects and competencies in sustainable development into university degree programmes. This has occurred, for specific subjects, with degrees in Pedagogy, Social Education or Environmental Sciences at UNED. This work is then continued via curricular sustainability, with the aim of introducing sustainability as a significant element with the highest possible number of ECTS (European Credit Transfer System) in all the university programmes. With that purpose in mind, there is a UNED-funded research project that aims to contribute to the effective inclusion of sustainable development in the teaching of all UNED programmes of study.

The UNESCO Chair has carried out several innovative educational projects on sustainability, as it understands that innovation is one of the foundations on which the broadening of thinking processes and practices on sustainable development must be based. Its activity has taken place mainly via the Programme of Networks for Educational Innovation, which is maintained by UNED. To date, four projects have been managed within that framework.

The UNESCO Chair has initiated a new research line on climate change, in which two doctoral theses are being developed. The goal here is to contribute, from within the field of education, to tackling and mitigating one of the most serious environmental problems that now affect the planet and humankind. The approach and treatment adopted regarding the climate change challenge in the next few decades will be crucial for our shared future.

In this connection, the UNESCO Chair has participated, along with eight other European universities, in an international EU-funded research project entitled 'The Lived Experience of Climate Change: Interdisciplinary e-module development and virtual mobility'. The work carried out has been widely disseminated via publications in the form of both books and papers.

The UNESCO Chair is conducting research in the field of 'women and the environment', under the understanding that women are among the most committed and influential actors in everyday practices related to sustainability. This is especially the case in rural contexts, and in developing countries. Thus, in 2007,

a book entitled 'Mujer y Medio Ambiente: los caminos de la visibilidad', ("Women and Environment: Paths to visibility"), was published. This publication puts forward questions and proposals in an interdisciplinary manner, and is the result of a number of conferences organized by the UNED Chair around this theme. One doctoral thesis related to this specific topic has been prepared.

The UNESCO Chair collaborates with other institutions and national bodies to organize conferences and symposiums about sustainability. The presence of the Chair is permanently in demand at events of such importance as the biennial National Congress on Environment, or the 'Projects and Utopias for a Better World' congresses. On other occasions, it is the UNED Chair itself, which organizes conferences and seminars on this topic.

The UNESCO Chair collaborates with other higher education institutions internationally, with the aim of creating synergies and projects that involve experts in higher education from different countries. In addition to the aforementioned European research work about climate change, it is worth highlighting the collaboration carried out with the 'Applications of Life Sciences' research and transfer centre, at the Hamburg University of Applied Sciences, in Germany. Up to the present, our Chair has participated in the writing of four books in English about different aspects of sustainable development, all of them edited in Frankfurt by the publishing house Peter Lang. Additionally, our Chair has cooperated, among others, with the Democritus University of Thrace, in Greece, on the Report entitled 'Higher Education and the Challenge of Sustainability: Problems, Promises and Good Practice' (2007).

Our collaboration with Latin American universities and organizations is constantly maintained via formal and informal exchanges of ideas, teaching staff, materials, etc. – one of our main aspirations is contributing to the broadening of thinking and sustainability practice in that area. In fact, one of the most relevant publications by our UNESCO Chair (a book on sustainable development in the context of the UN Decade, which is branded with the corresponding logo and was published in 2006), was put together, in collaboration with the UNESCO regional bureau for

education, whose head office is located in Santiago de Chile under the title '*Sustainable Development: its Environmental and Educational Dimension*' (UNESCO, 2006). In addition, the UNESCO Chair director acts as an international adviser for the International Earth Charter and, along with the Chair team, has carried out publications and activities with the team that directs this project in Costa Rica. A text entitled 'Good Practices using the Earth Charter', published by the International Earth Charter, deserves special mention.

Contributions of the UNED UNESCO Chair to the UN Decade of Education for Sustainable Development

Our Chair subscribes to the scope of strategic performance dictated by the UNESCO Executive Board:

1. Enhancing synergies with different education and development initiatives (EFA, MDGs, UNLD, EDUCAIDS), and strengthening partnerships among ESD stakeholders;
2. Developing and strengthening capacities for ESD;
3. Building, sharing and applying ESD-related knowledge;
4. Advocating for ESD, and for increasing awareness and understanding of sustainability.

Our vision is based on the approach described above, and it focuses on the following areas:

- *Research* via participation in national and international programmes and projects about sustainability.
- *Training*, through international postgraduate programmes focused on education for sustainable development.
- *Cooperation* with Latin American institutions and universities to contribute both to social development policies, and to the management of social transformations, including emerging problems.
- *Contribution* to the reinforcement of communication and information about sustainable development

by means of our own web site and the international network of UNED postgraduate degree-holders.

As mentioned previously, our UNESCO Chair adopts a systemic-complex and comprehensive approach. It does this not only to interpret reality, but also as the very essence of its activity and its programmes of study, and with regard to the projects themselves. This methodology is also noticeable in the structure of the Chair, and in the interrelations that take place in its areas of work: research, training, information, and cooperation, which continuously feed off one another.

Our UNESCO Chair followed the UN Decade model, to which it has committed since its creation, contributing via different activities. The main goal is to educate people towards sustainability, with an approach that centres on three types of objectives (Novo, 2006):

1. Human objectives (focused on the personal and professional development of the students);
2. Strategic objectives (to promote changes in society and in models of resource use and management);
3. Curricular objectives (concerning the contents, methods and feedback mechanisms of the process itself

Regarding the competencies that are necessary in order to educate towards sustainability, the UNESCO Chair believes (Murga, 2014) that at our universities, it seems appropriate to highlight three different lines of work whose focus is the systematic training of competencies for sustainability:

1. Diagnoses of the situation based on evaluative research carried out regarding the presence of competencies in sustainability in university degrees (and constructing the instruments to achieve that end (questionnaires, templates with categories for analysis, etc.)
2. Methodological innovations in the training processes, to reinforce the acquisition of general competencies in sustainability by students
3. Teacher training, both initially and continuously, in the necessary competencies to lead training processes within the framework of education in sustainable development.

The main fields of work of the UNED Chair

Our UNED Chair's main fields of work over the past ten years have revolved around the following topics:

- Contribution to the analysis and interpretation of the global, national and local problem areas. A great deal of conferences, talks and communications at congresses have been offered based on the analyses obtained from the UNESCO Chair's research projects, whose team has also collaborated at congresses and symposia on this topic. The following image reflects some of the most relevant events:
- Educational dissemination of the main principles of sustainable development (in the ethical, conceptual and methodological aspects) and strategies and channels to find a solution to the ecological and social problems from a sustainability viewpoint. With this aim in mind, in 2006 we published a monograph entitled *El desarrollo sostenible, su dimensión ambiental y educativa* (Sustainable development: its environmental and educational dimension), co-published by UNESCO and branded with the logo of the UN Decade. This book is being used as a reference tool in numerous Spanish and Latin-American universities. In 2009, the UNED Chair collaborated on a special issue of a scientific journal, *Revista de Educación*, (at journal citation report level), on education for sustainable development in which notable national and international specialists participated. In 2012, the UNESCO Chair collaborated on the Higher Education in the World 4 Report (Higher Education's Commitment to Sustainability: from Understanding to Action), published by Palgrave MacMillan, with a worldwide readership. Furthermore, the UNESCO Chair has collaborated on a large number of publications and scientific papers (50 papers in the past few years). It has also developed a postgraduate specialist and Master's degree at international level, on environmental education and sustainable development, geared towards key people (managers, trainers and decision-makers) in the international sphere, with particular emphasis on Latin America. Over the past ten years, the UNED Chair has trained several hundred professionals, involved

in education, planning and management, about development. It has thus contributed to reorienting their processes of thinking, and their actions, through a focus on a sustainable-development approach. This has had a true multiplying effect, as their training has had an immediate impact on their decision-making, in the case of professionals, or on the creation of courses at their universities, in the case of professors.

- Research, via the participation in national and international Research + Development + Innovation (R+D+I) projects on the following themes of work:
 - Research on the historical origins of unsustainability; on the paradigm shift that is necessary; and on the possible future scenarios based on a new development model.
 - Research on science-art-sustainability relations for the interpretation of environmental problems, and the search for innovative solutions through integrated complex knowledge.
 - Research on women-nature-sustainability relations, emphasizing the role of women as agents of development.
 - Research on curricular sustainability in higher education

Perspectives for the future: Contribution to the UN Global Action Programme Education for Sustainable Development

The Chair will continue collaborating with the UN Global Action Programme for ESD, which began in 2015, in the areas of research, training, cooperation and dissemination by emphasizing the dissemination and interchange of those practical experiences that have proven themselves to be viable in the area of sustainability.

The continued work on networks will be crucial, both at national and at international level. As will the grants programme for Latin American professionals and university lecturers, as an incentive to strengthen ESD competencies in the different countries covered.

Furthermore, the UNESCO Chair is continuously committed to the training of postgraduate researchers (eight PhD theses in progress), and of professionals in different areas, thus opening new strands of work and research on the theme of sustainability.

Similarly, as a result of recent research work, the UNESCO Chair is progressing in the design of MOOCs (Massive Open Online Courses) to train teaching staff in sustainable development, so that those lecturers who lack the time or resources to complete an official programme can have access to quality educational contents that will facilitate the introduction of sustainability into their classrooms.

Finally, the Chair will continue working to ensure that ESD grows and prospers in order to offer a healthy and hopeful future to subsequent generations.

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Teaching Key Environmental Topics on Sustainable Development:

Implementing Educational Project Technology

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Introduction

Lifelong education in ecology is a component at a number of different levels of the educational system of the Republic of Armenia. Currently, reforms in the educational sector are aimed at improving the performance, efficiency and effectiveness of the sector, while ensuring high-quality and equal access to education services for all, as well as improving transparency and accountability across the sector. This package of reforms requires a new way of integrating global issues into the educational sector, based on the key topics outlined in the UN strategic programme on Education for Sustainable Development (ESD).

Environmental issues regularly throw up new challenges for educators who are striving to develop new programmes. To solve these problems, new educational technologies are being tested, especially project technology. Practical testing and research work are being carried out, and a participatory action plan has been developed. Educational technologies involved in vocational education enable educators to present the constantly changing issues of sustainable development in an integrated format at the global, regional and local levels. Projects are being tested at different levels of professional education, which are then implemented and evaluated, together with both educators and learners.

The key environmental topics of sustainable development are addressed through the implementation of educational technology, enabling learners to gain new knowledge, develop special

competences, skills, and values oriented to diverse situations, and to carry out research work. Most importantly, changing people's views enables them to make the world more secure, thereby improving their quality of their lives.

Today there is a need for citizens to have a clear view of the integrity and balance of our planet, who will realize that, for the development of society, there needs to be stability in the natural ecosystems, proportionate economic development, and an ensuring of appropriate social conditions. And this can be reached if we use education as a powerful tool. (UNECE Strategy, 2005).

Currently, one of the main problems is how to develop new approaches to environmental education for children and young adults at a time of environmental crisis. The main objectives of environmental education are to raise learners' awareness of problems related to environmental protection, and to develop their ability to solve them through their participation in the learning process (Gasparyan et al., 2013).

Environmental education includes not only teaching and learning, but also awareness-raising from early childhood to adulthood. Modern environmental education is directed towards:

- supporting the dissemination of information on environmental protection, and its historical development;

- developing new methodological standards and scientific approaches to environmental problem-solving;
- increasing society's civil responsibility for participating in environmental problem-solving processes with regard to sustainable development;

Box 1: UNESCO Chair for ESD

The UNESCO Chair was established in 2011 at the Centre for Ecological-Noosphere Studies, as a fundamentally new type of UNESCO Chair. The Center for Ecological-Noosphere Studies of the National Academy of Sciences of the Republic of Armenia (Ecocenter NAS RA) unifies a number of laboratories and individual researchers carrying out fundamental and applied studies in ecology and environmental studies, and serves as a think tank.

Interdisciplinary investigations performed at the Ecocentre are oriented towards conducting complex ecological assessments, and towards developing the scientific and methodological fundamentals of ecological expertise and the optimization of natural resource management processes.

The main purposes of the UNESCO Chair on Education for Sustainable Development are to promote ESD through the integration of scientific, educational and innovation processes.

The activities of the Chair are based on diverse lines of research carried out in the Ecocenter labs, also resulting in the development of new curricula for undergraduate and post-graduate degree programmes.

- strengthening learners' knowledge of, and orientations towards, the ecological and social dimensions of sustainable development;
- support the creation of a harmonious relationship in the system composed of society, nature, and the economy.

Each period of time has its own special ecological paradigm that expresses the views, principles, conditions, and relative sustainability of values, which characterize the relationship between humans, nature and society. If until the middle of the 20th century, the ecological paradigm tended towards the anthropocentric idea i.e. everything for mankind, then in the 1970s a new paradigm appeared: an environmental, or eco-centric paradigm characterized by the following features:

- harmonious development of nature and society; a beneficial unity,
- scientific decision-making to satisfy human needs,
- global activity of environmental systems and implementation of new technologies.

Environmental lifelong education is a component of the integrated educational system of the Republic of Armenia, and covers different educational levels. Currently, the educational sector is involved in a process of reform. The package of reforms requires a new way of integrating global environmental issues into the educational system, based on the key topics included in the strategic programme on education for sustainable development (ESD). Including new educational technologies in the higher education system presents an opportunity to address the main environmental issues, which are constantly changing on local, regional and global levels, on the basis of integrated knowledge. Some projects are tested at different levels of higher education, which are later discussed together with the participants and the teachers.

The Right to Education is one of the basic human rights. It is also a prerequisite for sustainable development. Furthermore, it is the most important factor for effective management, rational decision-making, and the development of democracy. It changes people's attitudes, and enables them to make the world more secure. It increases their quality of life, develops their competences, provides orientation in different circumstances, and enables research using new educational technologies (Epshtein, 2002).

There is a growing need to include innovative technologies in today's educational system, as it is impossible to solve problems using traditional teaching methods. Ecological problems regularly throw up challenges to educators trying to provide appropriate knowledge to different age groups. Environmental education is a dynamic, continuous and developing process that requires the introduction of new knowledge. To solve these problems, new educational technologies are being incorporated into higher education. This is especially the case with project technology, where both practical and theoretical work is carried out with the participation of practitioners.

Environmental education is based on the 'feeling-experience-decision-action' functional chain. Using project technology, the learner not only acquires knowledge about the problems, but also develops the competences to make and evaluate decisions concerning the environment, in changing situations, on local, regional and global levels (Martin, 2014). Environmental education is a developmental process and it should have an integrated approach; it should not be isolated from other subjects (Gasparyan et al., 2013).

Our studies show that, today, all levels of continuing education in the Republic require new ways of implementing education in accordance with the ESD strategy requirements. The introduction of new technologies contributes to team-building activities, and promotes personality development, academic skills, social adaptation, and knowledge of educational issues (Epshtein, 2002; Polat, 1999, 2004). Today, educational programmes in natural and social science in higher education should unify content and process. This would result in a greater awareness both of the need to improve the quality of the environment, and of the role scientific management can play with regard to natural ecosystems, while also creating new ideas and flexible programmes to meet current needs.

Environmental knowledge, and its practical application, is quite complex. On the one hand, the students' task is to solve important environmental questions and to learn about the topic they are interested in, as well as to study the urgent problems of a given field. On the other hand, these very important questions cannot be included in existing courses. To smooth over this contradiction, it is

necessary to implement educational technology, which can integrate a variety of disciplines so that students are able to conduct both individual and collaborative research activities. At the same time, it is necessary to preserve the traditional emphasis of individual teaching courses and to create an opportunity for interdisciplinary analysis (Navasardyan and Sahakyan, 2008; Muradyan et al., 2012).

At present, 19 state higher education institutions (HEIs) are operating in Armenia and there are 65 private ones. There is also the International Scientific-Educational Center of the National Academy of Sciences, which has expanded its activities by starting Master's degree programmes. At present, the subjects of Ecology and Environmental Protection, and Nature Management, are being taught at all HEIs, regardless of specialization. More than 30 subjects relating to environmental issues, including key ESD environmental topics and sub-topics, are being taught.

Teaching technology

Project technology is a purposeful and complicated undertaking. It helps learners to gain new knowledge, orient themselves in different situations, make decisions, organize research work, and offer solutions, while simultaneously participating in the process. The project technology activity is a multilevel, interconnected system. Each piece of project work consists of four basic stages:

- Preparatory stage
- Planning stage
- Organizational research stage
- Results presentation stage

All the elements of the project technology are interconnected with each other and research plays a key role it is a system component and forms the learner's worldview.

Project implementation involves an initial collection of information by the learner, the undertaking of research and, finally, the drawing of conclusions. Moreover:

- It helps to strengthen educational motivation.
- Students overcome the fear of failure.
- They have a chance to express themselves, and have real freedom of choice to propose their own goals and targets.
- They become active participants as they are in the possession of information, and they feel free to interact with society (Petrosyan, 2012; Golub and Churakova, 2003).

As a result of the project, learners create websites, produce publications, videos, e-newspapers, maps, consulting packages, directories, dictionaries, scripts, travel notes, virtual tours and more. The project work also allows for the assessment of each participant's, and of each group's, knowledge level, skills and abilities, and is based on the main components of the project. It is necessary to take into account the relevance of the topic, the process-quality of the main outcome, and the work itself (Golub, 2003; Pakhomova, 2003; Polat et al., 2004). It should be integrated and combined so that it illustrates global topics with different specific subjects (Guzeva, 1995). The main components of the project work include:

- Basic knowledge of a variety of disciplines is introduced, as far as possible in a holistic manner, accounting for their interrelationships.
- Natural sciences are included to provide descriptions and interpretations of the surrounding world. As a unified whole, it is associated with philosophical views about the universe.
- Based on the learners' age, interests, abilities and knowledge, the educator should differentiate project work in accordance with the degree of complexity and specialization.
- The development of special competences is a necessary component of project work, but also takes place in other classes.

How projects should be implemented depends on their form. When studying environmental issues, project technology allows the implementation of individual and group studies, while promoting tolerance and cooperative competences (Pakhomova, 2000, 2003; Abramyan et al., 2014).

For this purpose, a project was carried out involving both work done inside, and outside, the classroom. Setting up the project, involvement in the project activity, and presentation of the results, were done inside the classroom. This project was implemented in the framework of natural and social science courses introducing key sustainable development (SD) issues.

On the basis of these considerations, key environmental topics of sustainable development were chosen and developed through the use of educational technologies. These were:

- Biological and Landscape Diversity
- Environmental Protection (waste treatment)
- Ecological Principles/Ecosystem Approaches
- Climate Change
- Management of Natural Resources (including water, land, minerals, energy)

The teaching of these topics was carried out at all the levels of education while taking into consideration that Armenia has also joined international processes of education for sustainable development and emphasizes the importance of these processes, and takes responsibility for their successful realization.

Experienced project

In 2013-2014, within the framework of the subject of 'teaching environmental problems using educational technology', state-funded teacher training, and seminars, were carried out for the lecturers and students of pedagogical universities and the International Scientific Educational Centre as well as for educators, in cooperation with the UNESCO Chair on Education for

Sustainable Development of the Ecocenter, the National Institute of Education, and the Armenian Tree Project, a charitable foundation, in environmental education centres in the villages of Karin and Margahovit. The aim of the training programmes was to introduce stakeholders to the project technology, and implement it through the teaching of ESD environmental topics.

International practice was studied regarding the topic of 'teaching environmental issues using educational technology'. Project technology is considered to be a fundamental and innovative means of organizing environmental education. Since the 1990s, project technology has been a non-traditional teaching method among the educational technologies being carried out in leading countries around the world. It motivates learners to carry out research, and gives them an opportunity to find innovative ways of solving problems. Some currently-practiced teaching strategies and forms are being replaced by pedagogical technologies, to which our research work is devoted. The practices in European countries, the Russian Federation, the USA, and Canada, were studied and developed, and then presented during the training courses.

Higher education vocational training institutions with participants representing different levels of formal education were chosen for a training programme, which was prepared and implemented in two regions of Armenia and in Yerevan for a group of specialists. Teacher training and seminars were carried out in cooperation with the National Institute of Education of the Ministry of Education and Science and the ATP charitable Foundation. The UNESCO Chair on Education for Sustainable Development of the Center of Ecological-Noosphere Studies of NAS RA, as well as specialists providing education on sustainable management of biodiversity in the South Caucasus also participated. Consultation in various professional institutions was provided. A plan was drawn up for the project process organization, information was collected, and a number of measures were carried out, with the staff providing training. Materials were discussed and appropriate instructions were given. Projects were carried out and discussed in various educational institutions, and the best practice published.

Conclusions

Our survey shows that project technology implementation in different structures of higher education resulted in the beneficiaries (educators, students, teachers) acquiring the following knowledge, skills, values and competences:

- advanced environmental knowledge;
- special competences for orienting themselves in the field of information, and in different situations;
- competences for carrying out research;
- environmental and cultural values of using critical thinking to find non-standard solutions.

The initial version of the methodological manual was completed in 2015. Examples of best practice are provided in a methodological handbook for educators of both natural and social sciences to promote implementation of the project technology. It also provides an introduction to the new competence being developed. The Council of Europe defines competence as an ability and willingness on the part of an individual to learn throughout his or her whole lifespan. Competence involves promoting the formation and development of research, communication and collaborative skills of learners, and leading learners towards publically beneficial activities.

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Green Chemistry for Sustainable Development

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Mission of the Chair

Sustainability is the ability to provide a lasting, healthy, satisfying and just life for all people on Earth, now and in generations to come, whilst maintaining the health of ecosystems and the rights of other species to survive in their natural environments. The most commonly accepted definition of sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. As such, sustainability is a profound challenge for science and technology, and one that chemists are well positioned to address. Their scope to make valuable contributions ranges from providing an understanding of the molecular basis of nature and the human environment, to the development of the new products and energy sources on which a sustainable future will depend.

The primary mission of the UNESCO Chair in Green Chemistry for Sustainable Development is to promote the ideas of education for sustainable development (ESD), to help the chemistry community implement these ideas in practice, and to educate a new generation of chemists who will be able to transform the principles of green chemistry into reality.

The activities of UNESCO Chair are directed towards:

- Enhancing the appreciation of chemistry amongst the public;
- Promoting the key role of chemistry in solving many of the world's global problems;
- Enhancing the engagement of young people with scientific and technical disciplines;
- Alerting the public to the role of chemistry in meeting global challenges;
- Serving as a catalyst for international cooperation.

The advance of education for sustainable development in Russia builds on efforts made in the field of environmental education, which constitutes the greater part of ESD, in its best methodologies and forms. The 'greening' of higher education in technical subjects in the Soviet Union began in 1983, at the then Moscow Mendeleev Institute of Chemical Technology, on the initiative of its rector, the future Minister of Education, the academician G.A. Yagodin, who founded the Department of Industrial Ecology.

In order to bring knowledge of sustainability into the world of professional engineers, in 1995 the University became the first school in Russia to establish a department for the problems of sustainable development. Then in 2000, it established the Institute of Chemistry and the Problems of Sustainable Development at D. Mendeleev University of Chemical Technology. This unique educational institution now includes:

- the UNESCO Chair in Green Chemistry for Sustainable Development;
- the Department of Sociology;
- the Higher School of Environmental Sciences;
- the Higher Chemical College of the Russian Academy of Sciences;

- the Higher College for the Rational Use of Natural Resources.

The education department at the Institute has developed programmes and specialized courses, such as one entitled 'The Development and Natural Resources', for those of its students who are training to become chemistry teachers.

Integrating ESD and Green Chemistry into Higher Education

The Institute has considerable experience in integrating ESD into higher education:

- Since 1995 two compulsory courses on sustainable development, respectively entitled 'The Problems of Sustainable Development' and 'Industrial Security and Risks', have been included in the curricula of all departments and institutions of the Mendelev University.
- Since 2000, several summer schools have been organized at D. Mendeleyev University to provide young university faculty with innovative pedagogical methodologies. The participants discuss such concepts as sustainability, democracy and justice, as well as discourses on the reorientation of existing education towards sustainable development, and the best pedagogical practices and experiences at the international and national levels.
- The Institute organizes excursions to equip students with practical knowledge of education for sustainable development. These excursions have proven to be very successful, and selected results were presented to the Russian Federation's natural resources ministry. They also were included in the National Report on Lead Pollution of the Environment and its Influence on Public Health (1997). Moreover, they were, in recent years, sent out to the natural resources ministry's regional committees.
- In April 2007, the academic council of the Institute of Chemistry and the Problems of Sustainable Development at D. Mendeleyev University approved the professional oath taken during the graduation

ceremony. Its text is based on the main principles and values of sustainability.

In 2000, the faculty members of the Institute received the Russian President's Education Award for the creation of a system of life-long education for sustainable development (both the development of its scientific and methodological basis and its realization in the Russian Federation). In 2006, it received the Russian government's state Award in Education, for its work on innovative ways of developing higher education on the basis of its integration with fundamental science.

The establishment of the UNESCO Chair at Russia's Mendelev University of Chemical Technology was greatly inspired by the International Year of Chemistry, or IYC, in 2011. It has made a significant contribution to the success of the IYC, both in the Russian Federation, and at the international level, as it is about the chemical aspects of important issues of international concern, and it has opened new horizons for international cooperation in the field of green chemistry.

Examples of the Chair's activities

- In 2014, the Chair launched a Master's programme in green chemistry and sustainable development, which is the result of co-operation with the University of Genoa in Italy, and several other universities in the framework of a TEMPUS project, focusing on the creation of the programme 'Life-Long Learning Training and Master's in Innovative Technologies for Energy Saving and Environmental Control for Russian Universities Involving Stakeholders 'Green Master' (GREENMA)'.
- Published books and manuals on sustainable development for high school and university students.
- Organized a course in computer modelling and simulation games in ESD. The course provides a knowledge-base, and concepts of sustainable development, as solutions to global problems.

- Organized the seminar 'Sustainable Development and Education', which is open to the general public. Leading educators and scientists from Russia and abroad (Spain, Japan, Sweden, the Netherlands, Poland, the USA, etc.) have participated in its activities, as lecturers.
- Participated in different conferences and workshops to disseminate new educational techniques in the field of education for sustainable development, and to promote all aspects of chemistry, not just among members of the profession, but, increasingly, to the general public as well.
- Conducted research in the field of green chemistry, namely in the transformation of the element sulphur by means of high-energy and microwave irradiation in the presence of ionic liquids (green solvents).
- Conducted a sociological survey entitled 'Green Chemistry and Industry', in cooperation with the Institute of World Ideas, and Russia's ministry of industry and trade. The findings evaluate the level of knowledge, among representatives of the chemical industry, about the concept of green chemistry. The survey shows that the principles of green chemistry are being introduced in a number of companies, regardless of whether the managers know about green chemistry as a field of research. The study further reveals that there is demand for guidelines for dealing safely and profitably with the production of chemicals (Tarasova and Makarova, 2014).
- Conducted research on the lifecycle management of hazardous chemicals such as mercury and perfluoropolymers.
- Conducted numerous workshops dedicated to the social responsibility of the chemical industry.

As part of Mendeleev University's Institute of Chemistry and the Problems of Sustainable Development, the Chair is working to integrate sustainable development into high-school education. At this level, education for sustainable development should focus on teaching all subjects, through the comprehensive understanding and investigation of the laws of nature. In order for sustainable development education to be successful at the school level, there was an urgent need for special educational programmes, for teachers, on designing sustainable development curricula. Such training should allow them to use a trans-disciplinary approach in integrating sustainable development principles into different subjects of the formal school curriculum. This has already been done through public lectures, seminars and workshops, through the creation of new learning centres, through mass media (TV and radio) and audio-visual programs, as well as through local and national roundtables and conferences. For instance, the Chair participated in the 10th International Science Students Fair, in Moscow, from 8-12 August 2014. Here, 130 students, teachers and principals, representing 22 countries from all over the world, actively discussed the need for inter-disciplinarity in education for sustainable development, and the role of science education.

The creation, in Moscow, of centres of school-environmental monitoring, has turned out to be one of the most effective tools for the integration of sustainable development issues into the formal and non-formal educational processes in school education. These centres provide school students in the 14-16 age range with the opportunity to carry out scientific research projects. The programme has been developed paying special attention to students' levels of educational and psychological development. The experience of the centres, and the information gathered by the Chair, have proved very useful for further expanding this experience by implementing a compulsory course in ecology and sustainable development in all Moscow schools. The faculty of the UNESCO Chair organized the teacher training. Another example is the coordination of IYC activities in Russia and the other countries of the CIS, the Global Water Experiment being one of them.

Conclusions

To conclude, the work of the UNESCO Chair at Russia's D. Mendeleev University of Chemical Technology contributes to laying down the scientific basis for practices and procedures that protect society, and that encourage responsible stewardship of natural resources. It has promoted the service of chemistry to society. This project utilizes the global perspective of UNESCO to contribute to the enhancement of education in chemistry, and to advance public understanding of chemistry and the scientific method.

Now that the United Nations General Assembly has approved a new set of Sustainable Development Goals, there is a whole raft of new targets as part of a new, post-2015 development agenda. Now that such a large number of economic, social and environmental issues has been brought together in a single set of goals, and with the amount of scientific knowledge and research carried out to date, there is a great need for practical solutions. Now that the major issues have been identified and agreed upon, the network of UNESCO Chairs worldwide can be a powerful tool towards achieving these goals. The UNESCO Chair in Green Chemistry for Sustainable Development will work on a country-specific solutions-based framework, using the potential of our colleagues worldwide, to do just that.

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Activities on Education, Training and Research for Sustainable Development within the UNITWIN Network

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The UNESCO Chair

The Francophone UNESCO Chair on Education, Training and Research on Sustainable Development was created in June 2010. The UNITWIN network, with 25 universities and higher education institutions belonging to 17 countries, is associated to the Chair. The Chair's main purpose is to develop initiatives in the different fields related to sustainable development in formal education and vocational training and, in an approach to life-long learning and education for all, to promote co-operation with all other societal actors concerned with education. The creation of this Chair, at the mid-point of the UN Decade on Education for Sustainable Development (ESD), had an impact that has gone beyond the end of the 2005-2014 UN Decade, and into the next phase of promoting ESD.

The creation of an international UNITWIN network consisting of entirely, or partially, Francophone countries, throughout Africa, the Americas, the Middle East, the Indian and Pacific Oceans, and Europe, is very

rewarding for the UNESCO Chair. It requires taking into account the heterogeneous features of these different countries, and finding ways for all of the partners to adopt what are often, for them, new approaches, so as to find appropriate solutions to the specific issues they are facing. For instance, there is a great socio-economical difference in the campus management of a developing country in Western Africa, and a developed country like Canada; furthermore, the environmental and cultural dimensions also prohibit taking a stereotypical approach. This international network is of great importance for building strategic alliances to develop training and research programmes.

Furthermore, given the diversity of university members of the Chair network, particularly with regard to their disciplinary specializations, the collaborative educational and research programmes undertaken have required the partner universities to leave their academic silos and adopt both integrative and holistic approaches to their activities.

UNITWIN network of the UNESCO Chair of Montaigne Bordeaux University:

Algeria: Abdelhamid Ibn Badis University (Mostaganem)

Armenia: French University in Armenia (Erevan)

Belgium: Free University Brussels

Benin: Abomey-Calavi University (Cotonou)

Burkina Faso: International Institute for Water and Environmental Engineering (Ouagadougou)

Bulgaria: Sofia University "St. Kliment Ohridski"

Cameroon: Yaounde University

Canada: Québec University (Chicoutimi)

Egypt: Senghor University (Alexandria)

France: French West Indies University (Pointe-à-Pitre), Digital University for Environment and Sustainable Development (Lyon), French Institute for Pedagogical Research (Lyon)

Réunion Island University (Saint-Denis),

French Polynesia University (Papeete, Tahiti)

Hungary: Panon University (Budapest)

Ivory Coast: Abobo-Adjamé University and Cocody University (Abidjan)

Lebanon: La Sagesse University (Beirut)

Morocco: Mohammed V Agdal University and Mohammed V Souissi University (Rabat)

Mauritius: Mauritius University (Réduit)

Senegal: Cheikh Anta Diop University (Dakar)

Tunisia: University of Tunis

During the 2010 Bordeaux Meeting, in anticipation of the 2014 Japan Conference ending the UN Decade on ESD, the Chair elaborated a preliminary strategy for the next four years. This strategy focused on several main axes:

- Establishing dedicated courses in sustainable development involving faculty and student

exchanges throughout the programme, in order to give these courses a dynamic aspect, and to make the most of the skills of each member university.

- Providing initial training for teachers in sustainable development, as well as continuing training during short and medium-term placements. Teacher skills will be regularly updated thanks to online platforms, as well as digital universities such as UVED (Virtual University for Environment and Sustainable Development).
- Informing members and various partners of the network via the Chair's website. Systematizing Agenda 21 actions taken on the campuses of all member universities, with a special reference to the French Green Plan.
- Strengthening the partnership between universities, institutions, firms, local government and civil society by means of student and teacher exchanges, pooling training programmes, and teaching materials, etc., in order to be able to meet the actual needs of society.
- Opening the network to new countries in Africa, Asia, the Americas, and the Indian Ocean, with special attention being given to Laos, Cambodia, Vietnam and Madagascar.

Activities of the Chair

Over the period 2010-2014, the activities of the Chair focused on several types of actions implemented at both regional/national, and international, levels, and developed either in the academic framework, or in fields of actions involving diverse institutions. These included private or public foundations, or intergovernmental bodies such as the European Union, the International Francophone Organisation (OIF), the Agence Universitaire de la Francophonie (AUF), and the United Nations. These actions were identified together with the informal strategic orientation committee of the Chair. Moreover, the UNESCO Chair participated in other activities that were more or less related to sustainable development, including several national and international events such as conferences, networks, online platforms, and regional initiatives.

Activities at the regional level: ESD dedicated training courses

The creation and implementation of dedicated training courses, such as the certificate on sustainable development, or the University Diploma on ISO 26000 (guidelines on social responsibility), is much more efficient than offering a number of scattered courses. This first step is considered necessary because, in an integrated project, participants must take account of, and work together with, people from different disciplines. This approach is based on an assessment carried out during the RUCAS Tempus programme on ESD, and was implemented from 2010 to 2013.

University of Bordeaux actors have played an important role in two on-going processes: an interdisciplinary university certificate on sustainable development, and the University Diploma on ISO 26000.

The interdisciplinary certificate on sustainable development

In order to develop a real global approach to sustainable development, the UNESCO Chair created, in 2012, an interdisciplinary certificate entitled 'Main Issues in Sustainable Development'. This certificate was launched during the academic year 2012-2013, following a year of preparation during which numerous meetings were held with representatives of the five Bordeaux universities. Besides university lecturers, this certificate involves external speakers and trainers from professional and political bodies.

This certificate is intended for Bachelor's (licence) students at each of the five discipline-specific Bordeaux Universities. Courses address the most important sustainable development issues – ecology, the economy, health, philosophy, sociology, technology, production and consumption – in nine seminars offered by lecturers from the five universities. A short final thesis is required for completion of this certificate. Students completing the course receive 4 ECTS, or 0.5 points added to the term's final mark.

This certificate was considered by all participants, both teachers and students, as a model of education and training on sustainable development that met their expectations. This certificate will be offered to a larger

public in an extended approach of continuous training making use of eLearning.

The University Diploma on ISO 26000

This University Diploma (DU) is an innovative training programme more specifically targeted at those who wish to acquire new competences with reference to ISO 26000. This international standard provides guidelines for social responsibility, and was launched in 2010. Its goal is to contribute to global sustainable development by encouraging business, and other organizations, to practice social responsibility in order to improve their impacts on their workers, their natural environments and their communities.

This DU is also aimed at Master's students who would like to expand their theoretical knowledge and practical competencies to facilitate their entry into the labour market, and to professionals wanting to acquire useful skills in order to implement and monitor the functioning of their organization, and financial and human resources, with reference to ISO 26000.

This DU is being implemented in co-operation with the Polytechnic Institute of Bordeaux, The Kedge School of Management, the French standardization body AFNOR, and the local authority of the Gironde department.

Activities at the national level: The Green Plan and the Aichi-Nagoya Conference

The Green Plan

In compliance with the French law requiring that institutions of higher education should draw up a Green Plan for their campuses, the UNESCO Chair, together with French universities and Grandes Écoles (and more specifically with the six universities of the Aquitaine Region in the South-West of France), has developed local initiatives to contribute to the implementation of this Green Plan.

This Green Plan stresses the ecological management of the institution, as well as its social policy and its teaching and research work. This dimension is also found in the European Sustainable Development Strategy, with its nine key challenges. The aim of the Green Plan system

is to help institutions of higher education draw up their own sustainable development approaches.

Moreover, beyond the national framework, the UNESCO Chair is working with the other institutions in the UNITWIN network to implement this Green Plan, the framework of which has to be adapted to each institution's specific environmental and social-economic features.

The Aichi-Nagoya Conference

The UNESCO Chair was involved in the preparation of the Aichi-Nagoya Conference and was designated as special advisor for all French universities and Grandes Écoles, as well as for all Francophone universities under the aegis of the Francophone Agency for Higher Education (AUF).

The Chair prepared a global document to be presented at a special session at the Aichi-Nagoya Conference, with results from the UN Decade, and proposals for the post-DESD Global Action Programme. This event focused mainly on the four following themes: the implementation of the Green Plan in the French institutions of higher education (see above); the sustainable literacy test adopted in Rio during the 2012 summit; the role of ICTs and eLearning to promote a transformative approach for ESD, and; the digital strategy for ESD, elaborated as a follow-up to the sustainable literacy test, and aiming at a better link between higher education and different societal stakeholders, with a special focus on vocational training for sustainable development;

Activities at the European level

The UNESCO Chair has participated in three European programmes related to ESD: the RUCAS Tempus programme on reorienting university curricula to address sustainability, the Erasmus programme entitled Education for Sustainable Development in Protected Areas, and the Horizon 2020 Mediterranean Environment Programme, on pollution.

RUCAS Tempus programme

The UNESCO Chair was the French partner in RUCAS (Reorient University Curricula to Address Sustainability). The TEMPUS project was launched in October 2010 for a three-year period. The main goal of this RUCAS project was to support the development of ESD in the higher education sector in seven universities in three countries in the Middle East (Egypt, Jordan and Lebanon), with the help of four universities in five European countries (France, Greece, Ireland, Italy, Sweden).

On the occasion of this programme, the Chair had the opportunity to assess the progress on sustainable development achieved through the Bachelor's courses. The subject has been integrated for several years now into university curricula in Bordeaux (following the recommendations of national and European strategies on sustainable development). The Chair also had the opportunity to build upon this progress, to help Middle East universities implement ESD. High priority was given to integrated interdisciplinary approaches, even if this focus had not been supported with specific training.

The main results of the RUCAS programme were the implementation of ESD in the university curricula of these countries in the Middle East, and its assessment with the help of various ESD indicators.

Erasmus programme on ESD in protected areas

This programme sought to provide a high-quality intensive education course over a 14-day period (7-22 July 2014) to post-graduate students, enabling them to effectively apply education for sustainable development (ESD) in various types of protected areas (PAs) including national parks, biosphere reserves, and Natura 2000 sites.

The course was aimed at post-graduates with a genuine interest in gaining new competencies that would enable them to respond to the ever-increasing demands to teach and to work on sustainable development. Candidates had an academic background in the natural sciences, environmental sciences, social studies or education. The course was hosted by the Centre of Environmental Education in Amfissa, Greece, and was illustrated with field visits to the Parnassos National Park,

accompanied by local and regional officials in charge of the protected areas.

All of the main topics were approached through lecture presentations, combined with discussions and case-study group work, internet research and e-applications, workshops in the field, etc. Topics included: ecological principles and the function of natural ecosystems; various types of protected areas; sustainable management of protected areas; key concepts in ESD; evolution and related theories; the MAB Biosphere Reserves as learning places for ESD; the profile of the educator in the protected areas; planning, implementing and evaluating ESD activities in protected areas, and; current pedagogical methods and tools applied in ESD.

Forty-five students from nine European countries (Croatia, Cyprus, France, Greece, Italy, Macedonia, Malta, Slovenia, and Turkey) attended this course, which was provided in English by lecturers from different countries and institutions.

The Horizon 2020 training session in Rabat

The Horizon 2020 Capacity Building/Mediterranean Environment Programme (H2020 CB/MEP) is an EU-funded project which runs under the H2020 Initiative, and aims at enhancing capacities to address pollution problems at an institutional and society level.

The main objective of the project is to address the following problems: the low political priority given to the environment; insufficient capacities and resources at institutional and civil-society level, and; the insufficient integration of environment into sectorial policies such as agriculture, tourism, transport, and energy, as well as the inclusion of different actors. Addressing these problems is achieved through capacity-building and awareness-raising activities, and by promoting the integration of environmental issues in other sectorial policies.

Within the framework of this initiative, which was organized in Rabat in May 2013, a training session was organized as part of the Horizon 2020 CB/MEP project. The Mediterranean Information Office for Environment, Culture and Sustainable Development (MIO-ECSDE), and the University of Athens (NKUA), were in charge of this

training programme, with the support of the University Mohamed V Souissi (Rabat). It lasted two full days, and around 40 participants from 14 Moroccan universities from different regions of the country benefited from the workshop. The Bordeaux UNESCO Chair participated in this training session, together with professors from Mohamed V Universities in Rabat, both members of the UNITWIN network of the Francophone UNESCO Chair on ESD.

Activities at the international level

eLearning programme on SD for African schoolteachers

The UNESCO Chair has been participating, since 2012, in the implementation of an ICTs and eLearning programme to train African primary and secondary school teachers in ESD. This programme was developed under the auspices of the International Organization for the Francophonie (OIF), in cooperation with national educational institutions from the African countries of Burkina Faso, Cameroon, Senegal, and Ivory Coast.

This action is intended to provide distance training for schoolteachers needing special training in ESD. The UNESCO Chair is one of the main actors, in cooperation with UNITWIN members in Senegal, Ivory Coast, and Cameroon, as well as the Digital University for the Environment and Sustainable Development (UVED).

eLearning Africa conferences 2012 and 2013

Meeting the networking needs of the pan-African eLearning and distance education sector, the annual eLearning Africa Conference is the key networking venue for practitioners and professionals from Africa and all over the world. Every year, the annual conference brings together a vast array of experts and change-makers in the ICT and education industry, from about 70 countries.

The UNESCO Chair, in partnership with UVED – the Digital University for the Environment and Sustainable Development – participated in two successive eLearning Africa conferences, where it presented contributions on ESD and on the use of ICT and eLearning. These were the eLearning Africa conferences in Cotonou, Benin, in 2012, and eLearning Africa 2013, in Windhoek, Namibia.

Participation in the Aichi-Nagoya Conference

The UNESCO Chair was invited to participate in two events in the Aichi-Nagoya Conference: the international conference on 'Higher Education for Sustainable Development' and the workshop on ICT. The aim of the conference on Higher Education for Sustainable Development was to highlight the achievements of various higher education initiatives by detailing their contributions to addressing SD through transformations in vision, leadership and knowledge structures, and through engagement in other critical sectors. The conference also sought to identify the major pathways and challenges for the transformation of HEI, with a focus on scaling up and mainstreaming innovative practices in learning, knowledge-development, and research.

The UNESCO Chair was asked to undertake an assessment of progress achieved in ESD by higher education institutions during the 2005-2014 UN Decade. The report of this progress was presented in a dedicated session in Nagoya. All French and French-speaking higher education institutions participated in this assessment and reported on all fields related to ESD. The Nagoya report focused mainly on four points: whole-institution approaches to ESD and the campus Green Plan; the sustainability literacy test; training and competences for SD; ICT, digital tools, eLearning, and MOOCs.

The workshop on ICT

The Chair participated in the workshop on ICT and was the co-organiser of Workshop 7 in Cluster 3, in collaboration with the NGO Young Masters Programme on Sustainable Development (YMP), an international and scientifically based education program offered free of charge to high schools. This workshop, entitled 'Information and Communication Technologies on Education for Sustainable Development', will consider ICT and eLearning as key enabling tools offering everyone, regardless of their needs, levels and status, wide opportunities with regard to ESD.

ICT and eLearning have deep impacts on where, when and how ESD can be provided. There is a real need to integrate them at all levels, and to bring adequate answers to some of the main challenges of ESD. These

include: SD digital literacy (how to enable a large part of the population to achieve the digital literacy necessary to acquire the skills, knowledge and attitudes required by SD); production of digital documents (how to increase the production of digital documents while ensuring their currency and integrity, and serving the needs of various audiences); staff training (how to ensure the educational workforce has the eLearning and technical skills needed to employ technology effectively).

The future work of the UNESCO Chair

Following on from the end of the UN Decade of ESD in 2014, the UNESCO Chair has continued its activities with reference to the five action areas of the Global Action Programme, and, more specifically, to: point 1, advancing policy; point 2, promoting whole-institution approaches to ESD at all levels and in all settings; and point 5, accelerating the search for sustainable solutions at the local level. At the same time, we have been strengthening our basic activities in education, training and research for SD.

In addition to these activities in a holistic global framework, the UNESCO Chair will also focus on three important axes following the Francophone and digital strategies:

- Enlarging the UNITWIN network

Currently, 25 universities and higher education institutions from 17 countries are members of the Chair network. We are currently in the process of formalizing the membership of several universities from the South-East Asian countries of Cambodia, Laos and Vietnam, and from the Indo-Pacific countries of Comoros, Mauritius, Madagascar.

- Expanding the availability of digital resources

ICT and eLearning offer the opportunity to capitalize on knowledge and know-how to develop ESD, and meet the challenges facing many educational systems, including a shortage of teachers, the inadequacy or lack of facilities, or even inadequate teacher training. In

cooperation with the Digital University on Sustainable Development, UVED, we will increase the availability of digital resources and dedicated tools, and promote related innovative teaching methods.

- Extending the whole institution approach

The whole institution approach will be developed in all of the higher education institution members of the Chair network based on the Green Plan being implemented in all French HEIs. This process was launched two years ago, and has to be adapted to the environmental, socio-economic and cultural peculiarities of the different institutions in their respective countries.

In conclusion, the years following the conclusion of the DESD will see a comprehensive strengthening of the actions of the Chair on sustainable development, undertaken both on its own and as part of the network, as they have a key role in the different actions of education, training and research for sustainable development.

About the Authors

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A Decade of Progress on Education for Sustainable Development

Reflections from the UNESCO Chairs Programme

G. Michelsen and P. J. Wells (Editors)

The UNITWIN/UNESCO Chairs Programme, launched in 1992, today forms an extensive network of inter-university cooperation involving more than 700 higher education institutions in 128 countries worldwide. Through knowledge sharing and collaborative research in the priority areas of UNESCO's work in education, the natural and social sciences, culture, communication and information, the Chairs provide a vital contribution to the Organization's mission.

The current volume focuses on the activities undertaken by UNESCO Chairs dedicated to the field of Education for Sustainable Development (ESD) within the context of the UN Decade of ESD which culminated in the UNESCO World Conference on ESD, held in Aichi-Nagoya, Japan, 2014. The case studies included, showcase the good practices, applied research and curricula innovations pioneered by the individual UNESCO Chairs, as well as highlighting the challenges and lessons learned both for the new follow-up Global Action Programme (GAP) on ESD and the wider Education 2030 Agenda.



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