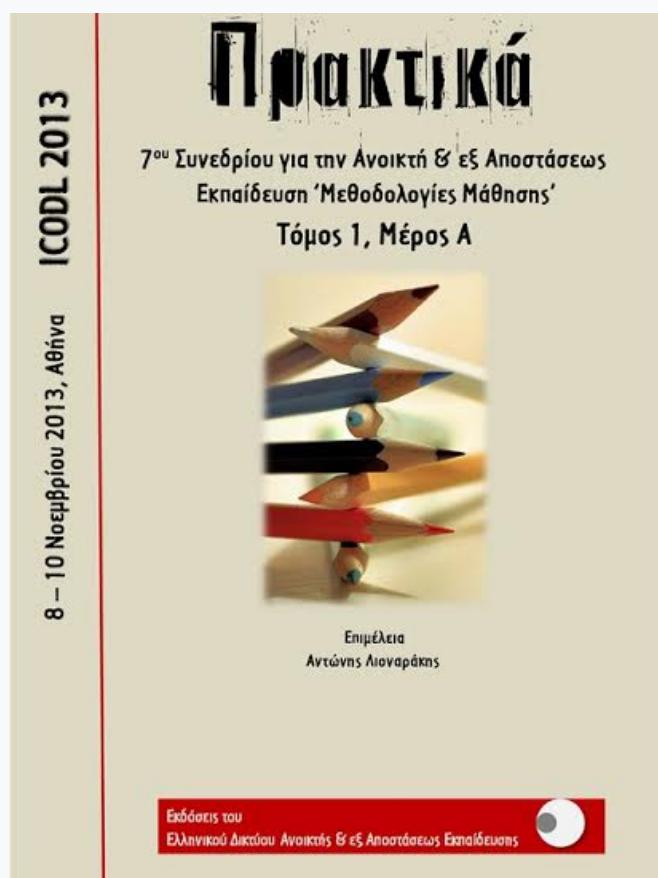


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A Web-Based Distance Learning Joint Master Programme on ICT in Education for Sustainable Development

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Abstract

This paper deals with a M.Sc. joint programme in the field of ICT in Education for Sustainable Development. The UNESCO and European Union Strategy for the worldwide implementation of ESD require numerous key elements, which appear to be indispensable for the success of the Decade of Education for Sustainable Development (DESD). These elements include partnerships, network developments, capacity building, development and innovation, and monitoring and evaluation. In this context, the UNESCO Chair of ICT in Education for Sustainable Development established at the University of Crete in cooperation with the RCE Crete took the initiative to jointly develop a M.Sc. programme on ICT in Education for Sustainable Development to be delivered online through a virtual learning environment. This project was approved by the European Commission and was financially supported (Project Number: 510212-LLP-1-2010-1-GR-ERASMUS-EVC and agreement number 2010-3494/001-001). This paper starts with an overview of the rationale and context for such a programme, continues with the main concepts involved in its course curriculum design and development. It ends with a description of the programme and a discussion for its potential contribution to education for sustainability.

Key-words: *Education for sustainable development, distance learning, ICT, online learning*

The Sustainability Crises and the Role of ICTs

We are increasingly confronted with complex, interconnected social, economic and environmental problems locally and globally. Humanity is living a crisis of sustainability that includes not only environmental issues such as climate change, ozone depletion, biodiversity loss, but also economic and social issues, such as poverty, social inequalities, violation of human rights, gender inequalities, loss of indigenous knowledge, etc. As depicted in Figure 1, that sums up at a glance these sustainability challenges, countries to the left of the vertical line are marking a score of 0.8 on the Human Development Index, which implies that people are not sufficiently meeting their basic needs. In countries above the horizontal dotted line and to the right of the vertical line, people are meeting their needs, but in ways that destroy ecosystems.

Human Development Index and Ecological Footprint

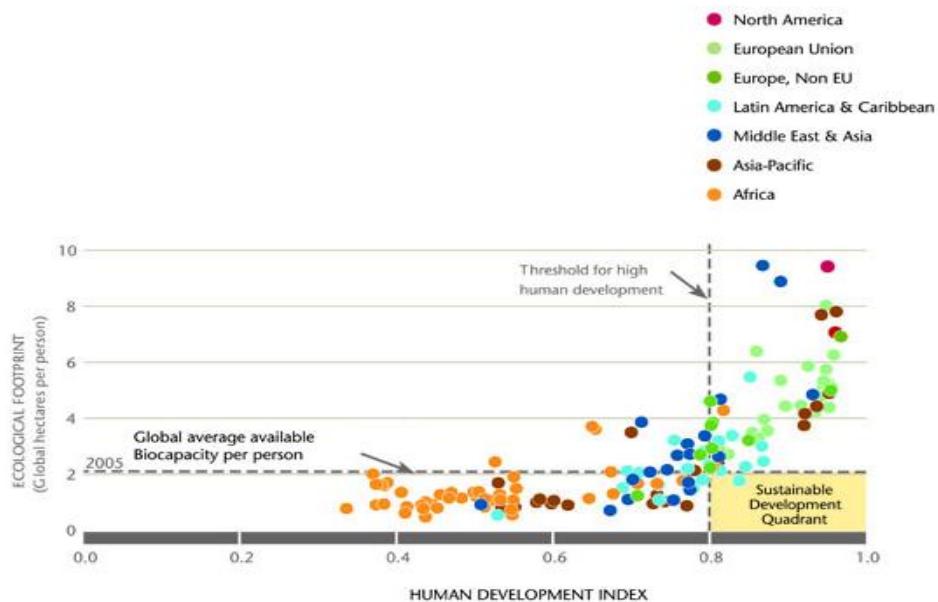


Figure 1: Human development index and ecological footprint worldwide

Source: Alliance for Global Sustainability and the Global Footprint Network. Cited in
<http://www.europeanbusinessreview.com/?p=1302>

A large portion of these local/global problems arise from the disparity in wealth and the seemingly oppressive nature of neo-liberal economic systems. As revealed by the UN's Human Development Index, economic development has been highly uneven and unjust across the planet. In general, in the globalisation era an enormous economic wealth has been accumulated almost exclusively in the developed world, while the world's poorest nations have grown even poorer (The Economist, 2012; UNDP, 2000). The increasing gap between rich and poor, between the affluent and non-affluent countries, between the current and futures generations, is widening. It seems that the whole concept of sustainability may not be compatible with capitalist social relations (Huckle, 2008:1993). The neo-liberal economic hegemony, despite its late interest in "green economics", it still prioritizes capital accumulation, at the expense of the ecological recovery, social equity and people's well-being. Despite claims of compatibility between economic globalization and sustainable development (Byrne & Glover, 2002; Panayotou, 2000), economic globalisation driven by hegemonic forces oriented to profit maximization are threatening environmental values and ecological health (Sachs, 2000; Sachs et al. 1998; Castells, 1998; 1996). Summing up, this crisis is largely based on the (Makrakis, 2012):

1. Unsustainable modes of production and consumption
2. Increased proliferation of military expenses and unsustainable use of technology
3. Generation of growing gaps of social, economic and political inequality
4. Globalization of the market economy driven by greediness of capital accumulation.

One emerging area concerns merging ICT with the United Nations (UN) call for the Decade of Education for Sustainable Development (DESD) to create a more sustainable development future. As education is seen key in the process of achieving

sustainable development, there is an urgent need for reorienting formal education to address sustainability (UNESCO, 2005). In this context, teachers are increasingly called upon to switch from roles of being consumers of outside expert knowledge and knowledge transmitters towards taking an active role as curriculum developers, knowledge constructors and transformative learning agents. To prepare teachers to function within this role, they have to receive an appropriate take off training and be prepared to on-the-job self-professional development. They should also be committed to play a leading role in promoting other teachers' professional development in their own schools, acting as resources and facilitators for service learning (Makrakis, 2006). The link between ICTs in education and sustainable development is being addressed by extensive debates and research which recognize the challenge ICTs bring to the reorientation of education towards learning to live sustainably (Makrakis, 2011a; Makrakis, 2008; Paas, 2008; Makrakis, 2006). ICTs can help learners explore concepts, engage in problem-based and authentic learning, enhance meta-cognitive skills and present information using multiple media (Makrakis, 2011b). All these are closely related to the goals, themes and learning objectives addressed by education for sustainability (UNESCO, 2005; Summers & Kruger, 2003; Fien & Tilbury, 1996). Indeed, three of the major forces shaping and driving the 21st century education are: 1) the development and diffusion of Information and Communication Technologies (ICTs); 2) the increasing demand for new educational approaches and pedagogies that foster transformative and lifelong learning and 3) the reorientation of educational curricula to address sustainable development (Makrakis, 2011b).

ICTs play an important role in advancing sustainable education in three ways: a) by increasing access to educational materials about sustainability (e.g., via distance learning, educational networks and databases); b) by helping to promote new ways of interactive learning addressing sustainable development issues and 3) by opening access to information and knowledge (Makrakis, 2010a). While ICTs can provide interactive mind/cognitive tools to support learning and develop new understandings and knowledge in areas of teaching and learning for sustainability, ESD themes integrated into the school curricula could provide a worthwhile context for ICTs in education (Makrakis, 2010b). For example, social, economic and environmental issues can provide meaningful and challenging contexts for developing a wide range of ICT skills. In general, ICTs can provide opportunities for learners to construct meaningful learning environments which can be applied to ESD such as: 1) engaging and challenging learners; 2) stimulating dialogue and social negotiation through new modes of social interaction; 3) learning by exploring, discovering, doing and reflecting; 4) constructing personal and collective representations of meaning; 5) supporting discourse in dealing with real-life problems; 6) representing dynamic relationships needed for knowledge construction; and 7) developing pupils' understanding of the implications of ICT for working life, society and the environment. When considering areas such as cultural diversity and intercultural understanding, health, HIV/AIDS, governance, natural resources, climate change, rural development, sustainable urbanisation, disaster prevention and mitigation, poverty reduction, corporate responsibility and accountability, and the market economy, there is potential to assess the impact of ICTs in these key sustainable development areas. More specifically:

- ESD themes integrated into the school curricula could provide a worthwhile context for ICTs in education. For example, social, economic and environmental issues can provide meaningful and challenging contexts for developing a wide range of ICT skills.

- ESD methods are conducive with constructivist and transformative learning theories, which can provide a context and rationale for using ICT-based learning tools such as concept mapping, modelling, social networking.
- When considering areas such as cultural diversity and intercultural understanding, health, HIV/AIDS, governance, natural resources, climate change, rural development, sustainable urbanisation, poverty alleviation, corporate responsibility and accountability, there is potential to assess the impact of ICTs in these key sustainable development areas.
- However, the so-called digital divide, especially for women and other disadvantaged groups, is still a problem that challenges educators and policy makers.

However, the following are major challenges that need to be addressed when attempting to merge ICT in ESD around the world.

- Education sectors are lagging behind to capitalize on ICTs potential in promoting ESD.
- ICTs can empower and help to facilitate greater access to ESD learning by disadvantaged people, marginalized groups and communities. However, the “digital divide” still remains a major challenge.
- ESD planning with new pedagogy is an essential part of building a whole school approach to ICT-enabled ESD.
- Dissemination and communication of information on innovative ICT-enabled ESD examples and practices may provide opportunities for ESD curriculum experimentation supported by ICT.
- A vision that facilitates an education model responsive to the development of ICT-enabled ESD is often missing among education planners and policy makers.

While many nations around the world have embraced the need for education to achieve sustainability, only limited progress has been made on any level. Some of the more prevalent challenges are: a lack of or inadequately trained professionals to provide inspired ESD; disciplinary boundaries between subject areas persist as well as lack of educational leadership to support transformative pedagogies to address sustainability. Our state of the art reviews on Master degree programmes in the field of ESD show that the great majority:

- focus on the environmental pillar of sustainable development, neglecting the other three pillars (social, cultural and economic);
- do not exploit the potential of ICTs in addressing sustainability issues, especially Web 2 technologies and use of open education resources (learning objects) available in the Web; and
- employ techno-centric approaches, meaning that curriculum is developed by experts without the end-users inputs.

There is thus need of Master programmes that are participatory, holistic, interdisciplinary and contextual, making use of ICTs both as learning pedagogies and means of delivering at a distance or through a blended mode. As a response to these challenges, seven European Universities with considerable experiences in the fields of ICT and ESD formed a Consortium to propose a project entitled “ICT-enabled Education for Sustainable Development.” This project aimed to develop a joint Master degree (deployed on an advanced virtual platform) in ICT in ESD which will be offered in English. The specific objectives were to:

1. Develop a joint Master on ESD supported by ICTs consisting of interdisciplinary modules amounting to 120 ECTS. A Diploma Supplement will also be issued with the joint degree.
2. Develop course modules addressing the environmental, social, cultural and economic pillars of sustainable development supported by social software tools and infused by open source learning objects.
3. Develop a virtual learning platform for uploading course content, enrolment and maintenance of student records, academic profiles, scheduling of units, course monitoring, liaison etc. combining two open source platforms (Moodle & Mahara).
4. Develop an online training toolkit addressed to university staff who, want to infuse ESD into their teaching and courses and/or apply virtual tutoring modalities.
5. Implement the training toolkit with 25 university staff from partner institutions to support the running of the joint Master.

Curriculum Design for the M.Sc. Programme ICT in ESD

Course curriculum design is not free of values. It includes curriculum decisions, choice of readings and content, teaching methods, modes of assessment etc. So, it is necessary to be exposed to the theory that underpins our approaches to course curriculum design (Makrakis & Kostoulas-Makrakis, 2012).

Major assumptions

- We do not see curriculum as a simplification of a linear process that dictates what is to be learned and how it will be learned without taking into consideration those concerned.
- The environment or context in which learning will take place is a critical component of the course curriculum design process.
- Emphasis should be placed on reflective/problem-based learning enabled through tools and services that facilitate “social networking” for virtual collaboration and virtual peer mentoring amongst learners and e-tutors.
- Knowledge is seen as a process of making meaning through interaction. In this sense, the curriculum is not viewed as a process shaped by interaction of those involved, whose knowledge matters.
- Putting strong emphasis on transformative pedagogies and a commitment to promote the values and principles of education for sustainability is a condition for building a sustainable society.
- While we are committed to a critical and transformative learning paradigm, we assume the complementarity of the opposite paradigms, in cases that their contribution adds value to our philosophical and methodological commitments.
- Course curriculum design integrates actions for: embedding critical literacies and learning in complex, realistic and relevant environments; applying social negotiation as an integral part of learning; integrating multiple perspectives and the use of multiple modes of representation; encouraging ownership in learning; providing adequate time for problem-based and inquiry-based learning.

In trying to bring together the main principles of the experiential, constructivist and transformative learning theories, a construct abbreviated as ExConTra was

conceptualised to underpin the pedagogical design of the M.Sc. programme (Makrakis & Kostoulas-Makrakis, 2012a).

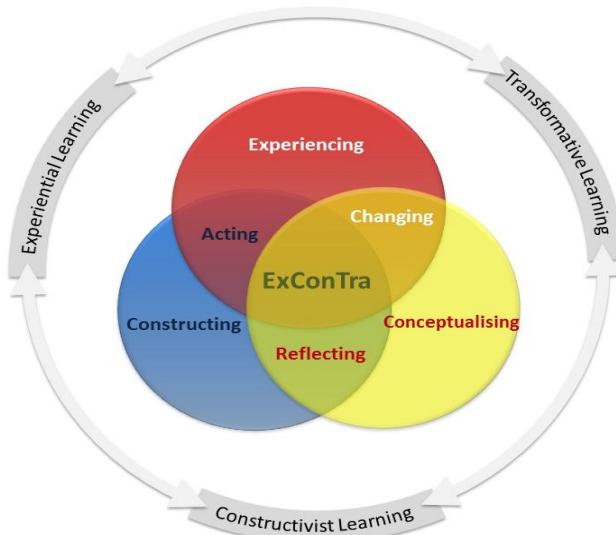


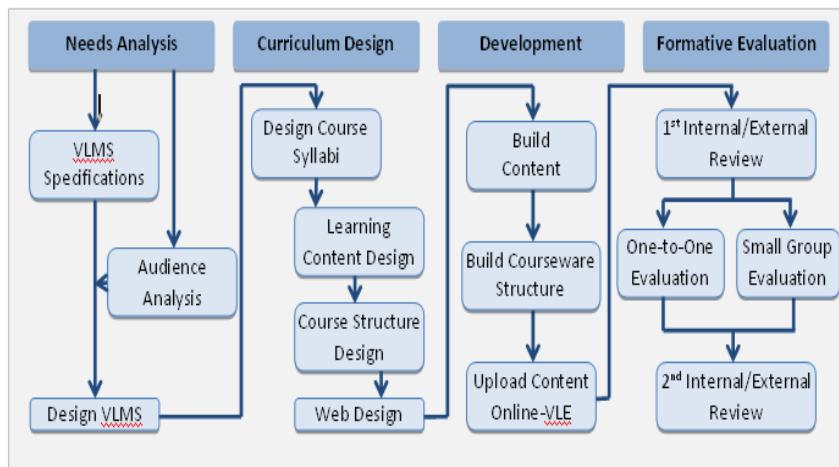
Figure 2: The ExConTra learning model

Examples of how ExConTra learning paradigm can be implemented in online course design include the following:

- Using Web-based authoring tools and scripting languages to develop learner-centred and self-instructional modules.
- Providing Web-based resources using hypermedia and multimedia links to support students' experiential, constructivist and transformative learning activities.
- Providing links to online databases, experts, virtual laboratories and knowledge repositories dealing with sustainable development issues.
- Providing web-based distributed learning activities that allow learners to brainstorm ideas, negotiate, reflect, peer critique, debate, construct knowledge, and develop action competences.
- Providing synchronous and asynchronous communication tools that help the knowledge construction process through self/group critical reflection.
- Incorporating learning principles and strategies that include active learning, collaboration, and cooperation.
- Engaging students in the application of knowledge through: inquiry-based learning; problem-based learning; higher order thinking; inter/cross disciplinary learning; and authentic learning.

Current instructional design principles and models do not explicitly address web-based interactive and user-system interface embedded in a participatory design process. The instructional design for online learning we developed is based on the ExConTra learning paradigm and partly adapted from Nam & Smith-Jackson (2007). As seen in Figure 3, this model consists of five design phases – needs analysis, curriculum design, development, formative evaluation and implementation– each of which has its own design processes. These phases, although, placed sequentially, in practice, there is much interaction among them.

Figure 3: A model for designing course design and development



In this context, new approaches to content distribution, particularly the OpenCourseWare (OCW) and Open Educational Resource (OER) movements, promise to make a vast array of content open to instructors and students to reuse, revise, remix, and redistribute (Bush & Mott, 2009). OCW and OER can be labelled as learning objects (LOs) indexed and catalogued in digital repositories. The LOs either simple (e.g., pictures, documents, video, audio clips) or complex (e.g., Learning Management Systems, portals, chat software, blogs, wikis, discussion boards) that can be easily transferred for re-use and adaptation in another place. The concept of LO was borrowed from Object Oriented Programming to address the issues of learning resources deconstruction and their subsequent reuse to compose larger courses or learning units (Hudak, 2007; Lim, 2007). LOs should not be viewed as merely “containers” of content, but as distinctive attributes of learning that can be “granular, reusable, searchable and interoperable” across different systems” to support knowledge construction and application in learning (Lim, 2007: 45).

The Virtual Learning Environment and the M.Sc. Course Structure

The M.Sc. programme is delivered online through the V-campus Virtual Learning Environment (VLE) which is a Moodle-based Learning Management System. The content/curriculum integrates reflective/problem-based learning and provides tools and services that allow for virtual collaboration and virtual peer mentoring amongst learners and e-tutors. Student-to-instructor and student-to-student communication is highly interactive. Learners engage in a series of online activities within the thematic area of ICT-enabled ESD through the use of various virtual learning tools. Students are presented with opportunities for self-paced learning, group learning, reflective learning and participatory learning.

Figure 4: Introductory information screen of the Virtual Learning Environment



The Master's programme consists of 12 courses, of which nine must be taken and is designed for a period of four semesters (two years) for full time students and a maximum of 10 semesters (five years) for part-time students offered through a virtual learning environment platform. The academic year is divided into two semesters of 20 weeks each, giving in total 60 ECTS credits (the European Credit Transfer System). These ECTS credits cover the relative amount of study related performances in which the workload of one year amounts to 1500 real hours. This workload includes synchronous and/or asynchronous modes of communication, case studies, self-study, assignments etc. To graduate, the student must acquire 120 ECTS credits: 90 credits (9 courses) from course work, and 30 credits from thesis work.

The study programme consists of three main parts: 1) core or foundational courses; 2) optional courses and 3) written thesis. In the first part, students are required to take the core or foundational courses which are designed to help them develop a broad understanding of ICT- enabled education for sustainable development as well as to prepare them for more specialized courses. In the second part, students can choose three out of six courses taking into consideration their personal, academic and specialized orientations. This part of the programme gives students the opportunity to learn skills in areas such as reorienting formal education for sustainability, curriculum design for sustainability education, educational planning and policy for sustainability as well as climate change education. The third part is devoted to the implementation and completion of the M.Sc. Thesis. The thesis is a practical application of the student's expertise in an individual area of interest. After the thesis has been completed, the student must present and defend his/her research results to the examination members, faculty staff and students.

Table 1: The course structure of the Master Programme

PROGRAM OF STUDY	ECTS
Year 1 Semester 1	30
Sustainability Theory, Systems Thinking and Transformative Change	10
Approaches to Educational Research for Sustainable Development	10
ESD Pedagogy and ICT	10
Year 1 Semester 2	30
Appropriate Technology, Active Citizenship and Education for Sustainable Development	10
Action Research and Participatory Action Research for Sustainable Development	10
ICT, Instructional/Learning Design and Education for Sustainable Development	10
Year 2 Semester 1 (to be chosen 3 out of 6)	60
Educational Policy and Planning for Sustainable Schooling	10
ICT, Climate Change and Geo-spatial Tools	10
Bio-cultural Diversity and Education for Sustainable Development	10
e-Learning, Virtual Worlds and Education for Sustainable Development	10
Teaching to Live Sustainably through the Earth Charter	10
Sustainable Leadership, Intercultural Communication and Education for Sustainable Development	10
Year 2 Semester 2	30
Dissertation	30
Total for the Master degree	150
Total for the Master degree needed	120

The M.Sc. on ICT in Education for Sustainable Development is an interdisciplinary program that focuses on developing competency and skill on Education for Sustainable Development enabled through ICTs. Sustainable development requires a process of change in which a balance is achieved among ecological, technological, economic, and social-cultural values, from the local to the global scale, in both the short and the long term. The program presents a range of theoretical and practical concepts and contexts of education for sustainable development enabled through ICTs and draws from a wide range of teaching/learning methodologies. This M.Sc. programme plays an important role in the transition towards sustainable development. The overriding objectives of the M.Sc programme are:

- to enhance knowledge for informed decision and policy-making on education for sustainable development issues;
- to enhance critical, analytical and integrative skills for developing ICT-enabled ESD curricula and training programmes;
- to produce professional experts on ICT-enabled ESD having the capacity to become reflective practitioners and agents of change, locally as well as globally.

After successfully completing the MSc programme, our graduates will be able to:

- Integrate interdisciplinary and cross-curricular thematic approaches to teaching and learning for sustainability
- Create ICT-enabled ESD instructional units, applying principles of learning and software engineering
- Produce plans and training material for the work-based training of other teachers and other practitioners on ICT-enabled teaching and learning for sustainable development
- Develop inter-disciplinary and cross-curricular thematic lessons plans integrating ICT and sustainable development issues
- Reflect critically on one's own theories, values, beliefs, learning, practice and professional development
- Demonstrate a theoretical understanding of leadership and the skills needed to offer effective leadership for sustainability in an intercultural perspective
- Critically examine dominant systems and paradigms and analyze complex sustainability issues locally and globally.

The MSc "ICT in ESD" is open to qualified students from around the globe who wish to develop knowledge, skills and capacities for infusing ESD, enabled through ICTs, in formal and non-formal educational settings. The student cohort is drawn from those who already work in an educational setting (formal or non-formal) or those who may wish to consider a career in the field of ESD, enabled through ICTs, or those who may consider undertaking future studies at Ph.D. level. Applications are invited from suitably qualified applicants irrespective of nationality and country of residence. Admission to the M.Sc. programme requires students to have achieved a minimum of a Bachelor's degree undertaken at an accredited institution, in a discipline relevant to the programme, which includes for example educational sciences, natural sciences and social sciences. Also, it is open to any candidate whose academic studies, interests and work are related to education for sustainable development. Since the programme is conducted entirely in English, candidates must demonstrate their proficiency in English by submitting appropriate documents: TOEFL (minimum required score: 230 on the computerised test; 570 on the paper test; 90 on the Internet-based test or IELTS (minimum grade required 6.5) or Cambridge Certificate of Proficiency (minimum grade required C). The Consortium Admissions Committee can accept excellent students with a somewhat lower TOEFL (550, 213, 550 or 79-89 respectively) or IELTS score (6.0). For candidates that have finished English speaking or bilingual secondary and/or higher education there is no need to provide evidence of English language competence. Furthermore, computer skills are highly required proven from previous courses taken and/or recognized certifications such as ECDL.

Discussion: Potential Benefits and Implications

The world faces a range of profound economic, social and environmental challenges due to unsustainable ways of knowing, thinking and acting as well as the impact of globalisation. At the same time education at all levels faces challenges related to the slow progress regarding the implementation of the UN Decade of ESD (2004-2015). This is due to a number of barriers such as, limited awareness and expertise in the field of ESD, overcrowded curricula, lack of suitable teaching methods and courses to address sustainability. There is also a shortage of graduate level education geared to sustainable development as well as barriers to accessing such sustainable education/s. The EU International Development Programmes, which since 2007 have come under the Lifelong Learning Programme (LLP), speak to the multiplicity of the strategic framework, and carry the potential for the continual success of fulfilling the World

Decade for ESD. This M.Sc. programme on “ICT in Education for Sustainable Development”, jointly developed by partner institutions, is the first of its kind worldwide, and is expected to advance ESD in Europe and globally; and respond to the priorities for reforming Higher Education through more accessible and flexible learning opportunities. The overriding objectives of the M.Sc. programme are:

- to enhance knowledge for informed decision and policy-making on education for sustainable development issues;
- to enhance critical, analytical and integrative skills for developing ICT-enabled ESD curricula and training programmes;
- to produce professional experts on ICT-enabled ESD having the capacity to become reflective practitioners and agents of change, locally as well as globally.

The following values and principles guide the ICT in ESD Master Degree programme:

- A commitment to social, ecological and economic justice
- A commitment to multiple perspectives including multicultural, interdisciplinary,
- inter/intragenerational, indigenous, local, and global perspectives
- The development of reflective practitioners and critical thinkers
- The empowerment of students as change agents with leadership skills to transform oneself and society
- The integration of theory, research, assessment and practice
- The fostering of participatory, inclusive, transformational, and lifelong learning
- The promotion of applied, experiential, critical constructivist and community/service-based learning
- To make all efforts for the realisation of the programme’s aims and objectives and the promotion of European Higher Education Area

The delivery of our M.Sc. programme online will significantly help to remove barriers that restrict access to, and success in higher level studies and increase equality of educational opportunity for adult learners worldwide. The career prospects for graduates include, but not limited to:

- Teaching across all education levels and non-formal education
- Government ministries and other public sector organisations concerned with ESD policy
- International and non-governmental organisations (NGOs) concerned with ESD
- Consultancies and development projects
- Applied research

It is essential that universities make considerable innovative efforts: 1) to improve their own “sustainability profile” by developing “learning environments” conducive to ESD supported by ICTs and 2) to develop new open and flexible postgraduate programmes that respond to the increased needs of experienced practitioners who want to play a key role in moving forward the issue of ESD. Offering a joint programme and academic degree should have significant advantages both for partner institutions, the European Higher education Area and internationally. It promotes virtual student and staff mobility which add value to a new dimension of mobility that is envisaged to give rise to scientific and pedagogical development, inter-cultural understanding and knowledge sharing. It brings together a European and international team of researchers, experts and educators who are working and developing various

pedagogical and technological tools that will be adapted in different social, economic and cultural contexts.

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