ICT in Education for Sustainability: Contributions and Challenges

Christina Marouli[1], Anastasia Misseyanni[1], Paraskevi Papadopoulou[1], Miltiadis Lytras[1]

Abstract
We live in a globalized society, with serious environmental problems, poverty for many, increasing gap between the wealthy and the poor, violence in many parts of the world, and access to a great wealth of information. Sustainable development and sustainable communities are urgent goals of our times. Sustainable living requires changes in social values and norms, in our daily lives and in social structures; it requires people with knowledge and skills, critical thinking, a sense of social responsibility and a desire to be active citizens. Education has a central role to play in this effort. But what kind of education can support the development of such citizens? What characteristics should it have? In order to address these questions in this paper, we will draw from literature on education for sustainability, active learning and transformative learning. Having identified the characteristics required for education for sustainability that mobilizes new behaviors, we will explore the role of ICT in this effort. How can the inclusion of online tools in education promote sustainable societies? What are its strengths and what challenges does it pose? Insights from our own teaching practices will be used.

1. Introduction
Sustainable living requires changes in social values and norms, in our daily lives and in social structures; it requires people with knowledge and skills, critical thinking, a sense of social responsibility and a desire to be active citizens. Dobson [1] referred to the need for "ecological citizenship", which implies "a commitment to the common good" so that we can ensure long lasting changes in our worldviews and behaviors. Education has a significant role to play in this transformation.

Despite its efforts and successes so far, Education for Sustainability (EFS) - or Education for Sustainable Development, which has a life of approximately 30 years, has failed to bring about the required changes in social practices. In this paper, we will discuss: What kind of education can empower citizens to bring about change towards sustainable societies? What characteristics should it have? How can the inclusion of online tools in education promote sustainable societies? What are the strengths of ICTs and what challenges do they pose for sustainable societies?

2. Education for Sustainability: Characteristics and Further needs
The main aim of EFS is to prepare citizens that can work for sustainable communities (see Tilburry [14]; Flogaiti [2]; Marouli [11]). EFS has adopted alternative pedagogies, in terms of goals and methods. Unlike traditional pedagogy, transfer of knowledge constitutes only a partial objective of EFS; more than that, EFS has a purpose: to bring about change in social practices and individual behaviors via developing critical thinking, skills for group work, and skills for effective social action. EFS combines knowledge (education *on* the environment), sentiment and emotional involvement (education *in* the environment), and a purpose (education *for* the environment). EFS has underlined the need for:

- Experiential learning; learning that starts from students' past but also present / shared experiences;
- Connection with the local reality and problems;
- Development of the participants' problem posing and problem solving capacities;
- Development of participants' ability to make 'local to global' connections and connect individual issues with social problems.

Although EFS has managed to increase people's awareness and theoretical knowledge of environmental problems and sustainable development, it has not been nearly as effective in mobilizing alternative worldviews and ways of being (behaviors). It has fallen into the trap of "progressivism" (Kincheloe and Steinberg [6]) uses the term (i.e. to indicate a negative reaction to traditional teaching methods; limited to didactics), while it often failed to propose a positive alternative pedagogy (i.e. an act of transmission of values and ways of knowing). EFS practices have generally been effective in

---

[1] Deree - The American College of Greece, Greece

promoting active learning in classrooms: projects are used to increase students' engagement in their learning; students' active involvement in data collection and analysis is expected; classes are often organized in ways that make learning student-centered; problem solving is typically used. However, they have not necessarily proven to be good examples of empowering and transformative learning – learning that leads to transformation of students' thinking and practices. What appears to still be needed in EFS practices is:

- Better understanding of the connection of individual behaviors with social reality and problems; the significance of individual and group action in bringing about change in social institutions and culture.
- Translation of awareness into change in lifestyles (individual action) as well as social practices (collective action) and social institutions / structures.
- Helping of students / participants to develop socio-political skills. Developing such skills and a better understanding of how the socio-political system works can lead to a sense of empowerment and higher chances for social changes.
- A more effective connection between the study of local problems and global concerns relating to sustainability.

3. Empowering education: EFS for social change

For such transformations to occur, empowerment in and via education is fundamental. Thinkers and practitioners like Paulo Freire [3] who introduced the concept of "critical pedagogy" in the 1970s and Ira Shor [13] who wrote about empowering education – among others - have contributed important insights in how education can empower communities and challenge social inequalities, leading to a more sustainable world.

Based on their insights, we distinguish the following elements as significant in an education that aims to empower learners:

- *Redefinition of the roles in the learning environment*: students – along with the instructor – as creators of knowledge and instructor as facilitator too.
- *Democratic dialogue*: implying a collaborative construction of the learning process, and an exploration that involves students and instructor as researchers, with questions that facilitate exploration rather than regurgitation of the knowledge that the instructor and readings have promoted.
- *Close connection between students' experiences and classroom learning*: classroom learning should be based on students' experiences – which are thus recognized as significant. We would also add that the classroom should provide a forum for common experiential learning, based on the local reality as this is the present shared reality of the learners.

Following this tradition, EFS – in order to empower students to change worldviews and behaviors:

- Should be firmly situated in students' and community experiences; should start with students posing questions of interest to them
- Should teach research methodology
- Should be interactive, promoting interactions and cooperation between instructor and students, students and students
- Should be characterized by democratic dialogue. The class should operate as a "think tank" and the instructor as a scholar who contextualizes and produces knowledge, while s/he shares his/her abilities with students.
- Should be based on the concept of "network", where all aspects are interconnected.

4. ICTs in EFS: Potential and challenges

Technological innovations and more specifically information and communication technologies (ICTs) have already been introduced in education and EFS in particular, such as enablers of rich contexts for interactions between learners and as flexible, dynamic, technology enhanced personalized learning systems.

ICTs have been shown according to Kirchner [7] and Lytras et al. [10]: to increase connectivity between students and instructor and among students; to enhance the exploitation of shared resources in learning repositories; Joksimovic [5] argued that social presence enhances the learning performance in academic contexts. From our experience, the use of online programs (such as Collaborate) can allow students cross-cultural interactions that enrich the learning experience, and when connected with learning activities locally, they can provide opportunities for local-global

connections. Furthermore, the use of online tools, such as discussion boards, wikis etc., in a learning process promotes interaction of students outside the classroom, as well as provides prompts for classroom discussions.

On the other hand, others have expressed concerns for the effectiveness of ICTs to contribute to a better and sustainable society. Marshall et.al. [10] indicate:

"… [R]egional economies and communities can be either enhanced or disadvantaged by information and communication technology. ... The disadvantage comes from the power that ICT products and services have in taking commerce, service provision, and governance away from communities that have been unable to bridge the digital divide." (page xxvii)

Thus existing social inequalities influence the outcome of the use of ICTs. Unequal access to ICTs by students and the community distorts the potential benefits of ICTs for sustainable societies. Van de Hove et.al. [4] indicate that what is required is "innovation with a purpose" (p. 79); technological innovations (like ICTs) should be seen as a means to a goal, "… hence the need to think deeply about what we want to achieve" (p. 78).

5. Conclusion

"A combination of innovative ways of thinking and doing and of innovative products and services can deliver the transformative capacity that will put us on a more ecologically, socially and economically sustainable path." [4], p. 79)

As ICTs provide flexibility in the space-time nexus of the learning experience, as well as access to a wealth of information and knowledge, they can help promote sustainability in several ways, but at the same time, they pose several challenges. ICTs in Education for Sustainability:

- Provide some useful skills for problem solving (technological products and services) that can facilitate actual real life solutions. Technology is a useful tool; however, its effectiveness depends on human choices and the purpose of its use.
- Can facilitate a more holistic approach, where "the 'local to global' community concept [can] be reflected within the content and learning process" [14]
- Can connect people across space, leading to significant individual benefits (e.g. access to large bodies of information, services, resources). However, this connection is limited as it is not conducive to an understanding of the political, economic, cultural context which affects relations, and thus truncates relational critical thinking.
- Can promote advanced contexts for human interactions, conducive to personalized micro learning environments customized to special needs, and thus against social exclusion.
- Can integrate dispersed resources from different providers and regions, possibly promoting a global unification of humanistic goals.
- Need connection with real life local problems in order to ground learning in real life experiences and real time problem solving. A sense of place and belonging is essential for learners to feel the relevance of selected bodies of knowledge and thus develop the motivation to consider changes in their behaviors.

ICTs in our days have been significantly diversified from the traditional tools and applications. The development of advanced social networking platforms, cloud computing systems and cognitive applications set new challenges for the role of ICTs in EFS. A main adjustment we have to make for the use of ICTs in EFS is the fine tuning of the physical presence and physical interaction of learners and the added value of technology supported learning environments. The aim should be the integration of old and new technologies with the goal to achieve community development, in a flexible educational context [12]. Research in this domain is essential for rendering EFS more effective in bringing about behavioral and social practices change.

The management of micro-content is also a significant challenge, since these types of learning content typically initiate learning interactions that provide the basis for the development of collaborative learning platforms. What is needed from this point of view is a thorough analysis of the objectives of Education for Sustainability, along with an analysis of the ICTs that are capable of generating transformative capacities that can support the effort towards sustainable societies at both the individual and collective levels.

References

[1] Andrew Dobson, Environmental citizenship: Towards sustainable development. Sustainable Development 15, 276–285 (2007).

[2] Evgenia Flogaiti, Environmental Education. Athens: Ellinika Grammata (1998)

[3] Paulo Freire, Pedagogy of the Oppressed. New York: Penguin Edition (1996)

[4] Sylvie van de Hove, Jacqueline McGlade, Pierre Mottet, and Michael H. Depledge, The innovation union: A perfect means to confused ends? Environmental Science and Policy 16:73-80 (2012)

[5] Srecko Joksimovic, Dragan Gasevic, Vitomir Kovanovic, Bernhard E. Riecke, and Marek Hatala, Social presence in online discussions as a process predictor of academic performance. J. Comp. Assisted Learning 31(6): 638-654 (2015)

[6] Joe L. Kincheloe and Shirley R. Steinberg (eds.), Unauthorized methods: Strategies for critical teaching. New York: Routledge (1998)

[7] Paul A. Kirschner, Facebook as learning platform: Argumentation superhighway or dead-end street? Computers in Human Behavior 53: 621-625 (2015)

[8] Paul A. Kirschner, Karel Kreijns, Chris Phielix, and Jos Fransen, Awareness of cognitive and social behaviour in a CSCL environment. J. Comp. Assisted Learning 31(1): 59-77 (2015)

[9] Miltiadis D. Lytras, Leyla Zhuhadar, J. X. Zhang, and Eugenijus Kurilovas, Advances of Scientific Research on Technology Enhanced Learning in Social Networks and Mobile Contexts: Towards High Effective Educational Platforms for Next Generation Education. J. UCS 20(10): 1402-1406 (2014)

[10] Miltiadis D. Lytras, Hassan I. Mathkour, Hassan Ismail Abdalla, Wadee Al-Halabi, Cornelio Yáñez-Márquez, Sean Wolfg and Matsui Siqueira, An emerging - Social and emerging computing enabled philosophical paradigm for collaborative learning systems: Toward high effective next generation learning systems for the knowledge society. Computers in Human Behavior 51: 557-561 (2015)

[11] Christina Marouli, Multicultural Environmental Education: Theory and practice. Canadian Journal of Environmental Education 1: 26-42 (2002)

[12] Stewart Marshal, Wanjira Kinuthia and Wal Taylor, Bridging the knowledge divide: Educational technology for development. EBSCO publishing (2009)

[13] Ira Shor, Empowering education: Critical teaching for social change. Chicago: The University of Chicago Press (1992)

[14] Daniella Tilburry, Sustaining curriculum policy and development in Environmental Education: A European action research project. European Environment 9: 24-34 (1999)