

UNLOCKING THE POTENTIALITY AND ACTUALITY OF ICTs IN DEVELOPING SUSTAINABILITY-JUSTICE CURRICULA AND SOCIETY

VASSILIOS MAKRAKIS
makrakis@edc.uoc.gr
University of Crete, Greece

ABSTRACT. While social justice is a frequently employed concept in the deconstruction and reconstruction of instructional practice in schools, sustainability-justice that, in addition to social justice, integrates environmental, economic and cultural justice, has not been so well discussed. This article explores a critical perspective of curriculum and ICTs potentiality and actuality in transforming education towards a sustainable-just society. The DeCoRe plus methodological approach has been developed and used in pre-service teacher education courses, with the aim to embed sustainability justice in school curricula. This process is highly enhanced through two major complementary trends, namely, Open Education Resources (OER) and OpenCourseWare (OCW), that are shifting the old ways of knowing, being, living together, doing and sharing, as well as the spatial and temporal boundaries.

Keywords: ICTs; curriculum; sustainability justice; DeCoRe plus methodology

1. The Sustainability Crisis and the Issue of Justice

The world today is facing various problems which threaten its very existence in the not so distant future (UNICEF, 2015; FAO, 2014). The unsustainable economic path experienced throughout the 20th century has created tremendous social, economic and cultural disparities worldwide. Humanity is living a crisis of sustainability that includes not only environmental issues such as ozone depletion, biodiversity loss, but also economic and social issues, such as poverty, social inequalities, violation of human rights, unequal trade, gender inequalities, and recent migration on an unprecedented scale. Social, economic, environmental and cultural injustices prevail in human society and this constrains us to seek an alternative human development path that “meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987: 43). More specifically, the asymmetries created by economic globalization in

the last three decades, have not only widened the disparities between the developed and developing countries, the wealthy and poor people, but also within countries across the world (Peters, 2014). It seems that the gap between the rich and the poor, between the affluent and non-affluent countries, between the current and new generations, seems to be further widening. Despite the late interest in “green economics”, in reality current global policies still prioritise capital accumulation, at the expense of the ecological recovery, social equity and people’s well-being.

Along with the worldwide and outspoken quest for sustainability, there is much hypocrisy in the way past and current world leaders approach sustainability issues and problems. From one side, global leaders persist on neo-liberal economic growth models, with consumerism being addressed as a key factor to economic prosperity, and on the other side, they proclaim the urgency for tackling sustainability problems, such as climate change, where consumption behaviors and production practices are its key contributors. At the same time, advances in sciences and technology are seen predominantly from a pessimistic rather than an optimistic perspective. An international study (Makrakis, 2012a) found a strong and pessimistic connection between environmental consciousness and attitudes towards the role and impact of science and technology on society.

The sustainability crisis is a crisis of values that education at all levels has reproduced, maintained and perpetuated. Thus, it, seems that educational systems and learning experiences did not provide us with the knowledge, skills and tools to understand what is happening in the world, and how to transform oneself and society towards more sustainable, just futures (Makrakis & Kostoulas-Makrakis, 2013ab; Sterling, 2004; Huckle & Sterling, 1999). Huckle (2012) suggests that teachers should be introduced to critical social theory that seeks to explain the role of Web 2 technologies in the recent wave of capitalist development that precipitated economic and ecological crisis and their potential to bring about more sustainable alternatives. He argues that such alternatives will be based on more radical and deliberative forms of democracy and citizenship enabled by the new technologies.

This paper claims that the issue of justice is critically important in dealing with the sustainability crisis. Thus, it is reasonable to introduce the concept of “Education for Sustainability Justice” (ESJ), as an alternative to “Education for Sustainable Development” (ESD) or, at least, to use both concepts interchangeably. Such an alternative is seeking to place much emphasis on the ethics and praxis of education for sustainability.

The concept of “sustainability justice”, conceptualised in this paper, reflects the four pillars of sustainable development: environment, society, economy and culture. The environmental justice component refers to the right of all people in the planet to enjoy an equitable, clean, safe, fairly treated and healthy environment as well as the right to social, economic and cultural wellbeing. It also addresses the ecological unity and the interdependence of all species (Bonorris, 2010). The social justice component addresses inequalities and injustices of all kinds, poverty,

racism, violation of human rights. Social justice is simultaneously a goal, a process, and a stance (Grant & Agosto, 2008). As a goal, social justice denotes equality of opportunities and outcomes for all people. As a process, social justice addresses the confronting and dismantling of oppressive structures and systems, as well as all other sorts of social inequalities (ibid.). The economic justice component addresses the issues of unfair trade, economic exploitation, the unequal distribution of wealth, racism and poverty. In an integrative way, the cultural justice component encompasses all the other three components of sustainability justice in the same way as it does to the three sustainable development pillars.

Sustainability justice is perceived as a process, and not an outcome, which: 1) seeks fair (re)distribution of resources, opportunities, and responsibilities; 2) challenges the roots of oppression and injustice; 3) empowers all people to raise their voice, needs and rights; and 4) constructs knowledge, empathy, compassion, social solidarity and action competences. The concept of sustainability justice expresses an ideal which should be infused in teaching, learning and curriculum processes and practices.

Unlocking the potentiality and actuality of ICT for sustainability justice, is not only a matter of technology, but concerns the ways we perceive technology, teaching, learning and curriculum. Teachers' roles as "transformative intellectuals" (Giroux & McLaren, 1996; Giroux, 1988) driven by the principles of new pedagogy enabled by new technology, are critical roles in these processes. In this context, "critical educators should take more responsibility within the system and take up their own share of responsibility for technology related decisions" (Jandrić, 2011: 82). The critical question that one should ask is: Are we preparing students to challenge the sustainability injustices or are we preparing them to reproduce and perpetuate an unjust growth-oriented global society? How can ICTs enable education for sustainability justice?

2. ICTs Potentiality and Actuality for Enabling Sustainability Justice

Web-enabled ICTs are challenging the foundations and boundaries of space, place, and time. As ICTs become commonplace entities cutting across all aspects of social, economic and cultural life, they hold considerable potential for promoting sustainability justice. Potentiality, in this context, generally, refers to any "possibility" that ICTs can have to reduce sustainability injustices prevailing the world. Actuality, in contrast to potentiality, is the change or evidence that ICTs potentiality for sustainability justice turns into reality.

In terms of potentiality, web-enabled ICTs have been increasingly promoted as a means for advocating and empowering the historically disadvantaged groups, such as women, the poor and minorities. A virtual space can provide opportunities for the underprivileged and excluded to raise their voices and generate discussion that can lead to action. For such social groups to benefit from virtual spaces, they need access and capacity to utilise ICTs. Web-enabled ICTs have the potential to

disseminate knowledge, skills and competences necessary for advancing advocacy, empowerment and change (Makrakis, 2014a). The potential of ICTs to help learners explore concepts, engage in problem-based and authentic learning, enhance meta-cognitive skills and present information using multiple media cannot be neglected (Makrakis, 2012b; 2010).

Over the last decades, two major complementary trends are emerging to transform the old ways of knowing, being, doing, living and sharing. One of these trends, digitised open education resources (OER), first initiated by UNESCO (2002), is transforming higher education by enabling individuals, institutions, and organisations to narrow the learning divide. Academics, researchers and learners are given the flexibility of accessing OER from anywhere and at any time, mostly without cost. The other trend in recent discourse is the emergence of OpenCourseWare (OCW), which is unlocking knowledge to everyone, anywhere. OCW has become a trend in hundreds of universities worldwide, providing free educational content to anyone, without social, geographical and temporal barriers. This innovation can be better seen as a free online library of course materials used to teach undergraduate and graduate courses.

These trends are based on virtual spaces, which have added a completely new perception of time and space. They have appeared as “alternative emergent cultures” that have created spaces for subversion and de-territorialization of the contemporary university by “divorcing information and communication technologies from values and ideologies of global neoliberal capitalism” (Hayes & Jandrić, 2014: 197). Indeed, web-enabled ICTs have changed our spatial and temporal dimensions by increasing access to rich and varied OERs available through online databases 24 hours a day. These trends can be considered as part of democratisation of education which entails higher levels of accessibility and affordability of OER and OVW, together with increased control of the learning process.

In terms of actuality, access to web-enabled ICTs is becoming a critical determinant factor that affects the right of everyone, everywhere to access and benefit from their transformative powers. The great majority of people around the world, most of them women and minorities, continue to be excluded from accessing ICTs. In this sense, technology has also exacerbated vulnerability, created new risks, and undermined sustainability justice (Meikle and Sugden, 2015; CARDET, 2014; Makrakis, 2012a). The “digital divide”, usually referring to the division between the Global North and the Global South, restricts access to the benefits offered by ICTs and has stronger effects on certain social groups, characterised by gender, ethnicity, and class.

It is, thus, assumed that unlocking ICTs potential for advocacy, empowerment and capacity building can have a significant impact for transforming education to advance sustainability justice, especially through the post-2015 framework of new Sustainable Development Goals (SDGs). However, ICTs do not advocate, empower or build capacities by themselves. According to Hayes and Jandrić (2014:

194–195), “technology is not an object, nor a subject, but a dialectical process of material and linguistic negotiation between competing social forces”. It is human agency that can unlock ICTs potentiality and actuality for sustainable human development and sustainability justice.

3. Unlocking ICTs Potentiality and Actuality to Enable Education for Sustainability Justice

The process of unlocking the potentiality and actuality of ICTs for enabling sustainability justice is not a matter of technology itself, but it is rather the way we perceive technology, teaching, learning and curriculum. Teachers’ roles and perceptions are of the most critical importance in this process, besides the need for the embedment of sustainability justice as an underlying philosophy in the teacher education study programs. In this context, there is need for a shift where teachers see themselves functioning as facilitators and mentors, as resources, as curriculum developers (Makrakis, 2006), and as transformative intellectuals (Giroux & McLaren, 1996). Each of these roles is associated with specific activities. Teachers as “facilitators and mentors” will guide and facilitate learners’ critical and creative thinking in a collaborative learning environment enabled by new technology. Teachers as “resources” will develop learners’ capacities for active citizenship and contribute to their fellow teachers’ professional development enabled by new technology. As “curriculum developers”, teachers critically assess school knowledge, reorder and enrich curriculum according to the principles of new pedagogy enabled by new technology. Teachers as “transformative intellectuals” are involved in developing a discourse that unites the language of critique with the language of possibility (Giroux, 1988). The main issue for the educators to function as transformative intellectuals, as Giroux (1988) states, is to make education more political and politics more educational. This means: 1) that school is a space of politics, in the sense that, the choice of the content of the curricula, as well as the educational process are formed by relations of power and struggle, and 2) the curricula and the educational concepts and practices should include political literacy (Giroux & McLaren, 1996).

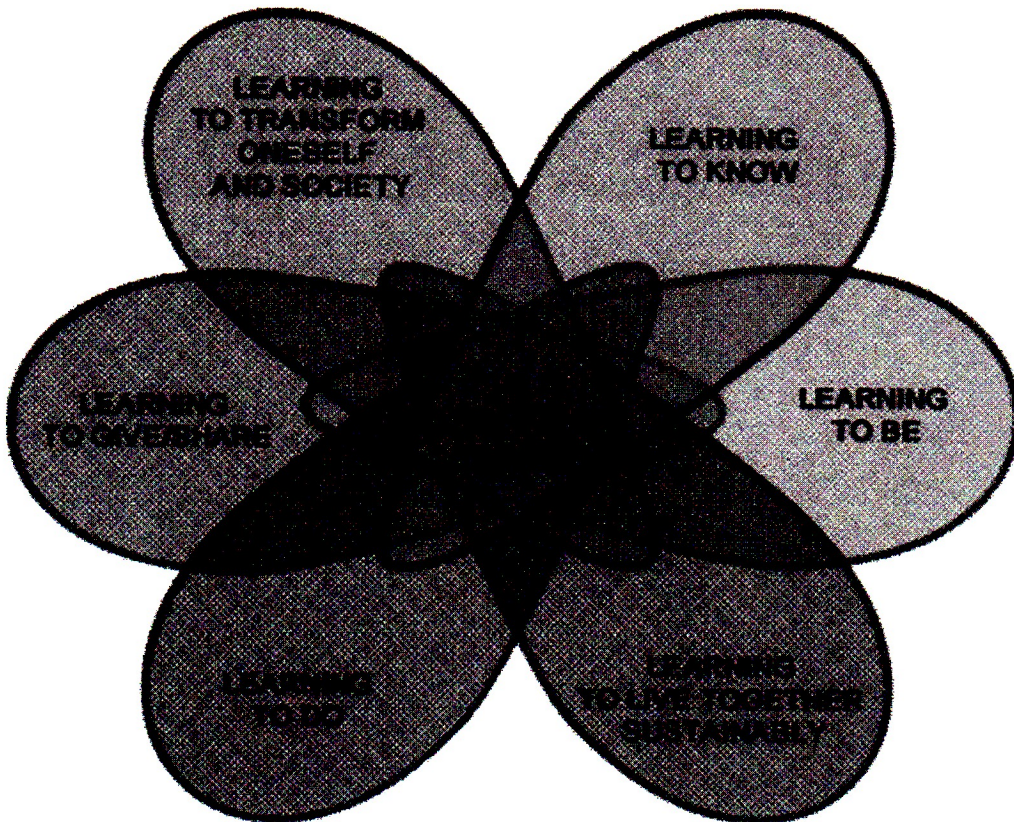
Questions around the connectivity of education for sustainability justice and ICT are not only questions about the “how”, but also the “why” and “what”. To advance such a role of ICTs for sustainability justice, there is the need for a shift to an alternative educational paradigm that alters:

- 1) Our way of being in the world (learning to be).
- 2) Our way of discovering others by discovering ourselves (learning to live together).
- 3) Our way of learning how to learn as well as appreciating all sorts of knowing (learning to know).
- 4) Our way of putting knowledge into action (learning to do).

- 5) Our way of approaching the marginalised and those living at risk (learning to give & share).
- 6) Our problematic frames of references – sets of fixed assumptions, habits of mind, meaning perspectives and mindsets (e.g. Mezirow, 2003) that led to the current sustainability crisis (learning to transform oneself and society).

In its 1996 report to UNESCO entitled “Learning: The Treasure Within”, the International Commission on Education for the 21st Century argued that education should be based on four fundamental pillars of learning: learning to know, learning to be, learning to do and learning to live together, which “provide maps of a complex world in constant turmoil” as well as “the compass that will enable people to find their way in it” (Delors et al., 1996: 85). At a later stage, the 5th pillar of “learning to transform oneself and society” was added by UNESCO. Makrakis & Kostoulas-Makrakis (2014) introduced the 6th pillar of “learning to give & share” in order to respond to the quest for merging volunteerism, social activism and learning (Figure 1 and Table 1). The idea of “giving and sharing” is, for example, inherent in the OER and OCW movements, through which the global knowledge is provided and accessed as a public good and that ICTs should be affordably accessed for everyone to construct, share, use and reuse knowledge.

Figure 1 21st century learning pillars



Source: Makrakis & Kostoulas-Makrakis, 2016

Table 1 Definition of the 21st century learning pillars

Learning to know	Concerns all processes and practices that lead people to experience, construct and transform knowledge for making sustainability a mode of life and being.
Learning to be	Concerns all processes and practices that lead to human self-actualisation, self-understanding, self-regulation and cultivating a sense of being versus having.
Learning to live together sustainably	Concerns all processes and practices that lead to a peaceful and non-discriminatory society and human co-existence with the natural world.
Learning to do	Concerns all processes and practices that lead to merging knowledge with action for building a sustainable future.
Learning to transform oneself and society	Concerns all processes and practices to transform their unsustainable values and behaviours and collectively engage to change society towards sustainability.
Learning to give and share	Promotes solidarity and caring attitudes to meet human needs as learners gain autonomy and purpose for their learning and civic engagement.

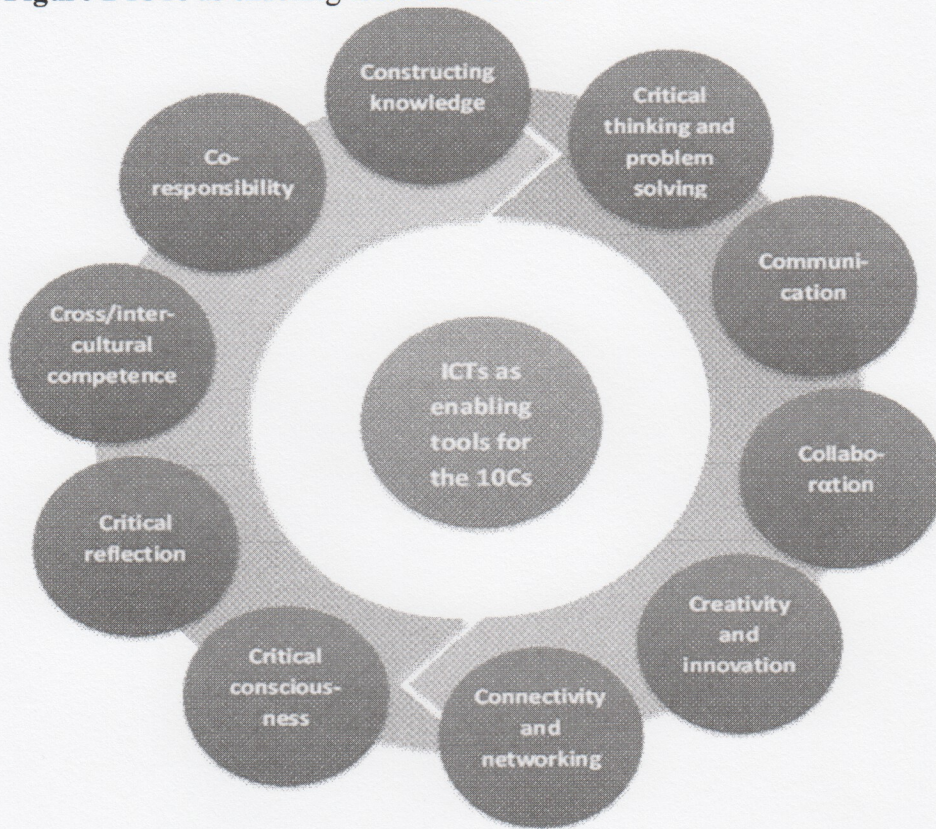
These six processes defined as key learning pillars for the 21st century can be enabled by the 10Cs depicted in Figure 2 (Makrakis & Kostoulas-Makrakis, 2016; 2014). According to Makrakis and Kostoulas-Makrakis (2014), in a world of rapid change driven by ICTs, along with the current sustainability crisis that threatens the very existence of humankind, education must go beyond the focus on the 4Cs (AT21CS 2012; Partnership for 21st C. Skills 2011; AMA 2010) to what they have termed the 10Cs.

Each of the 10Cs has its own role in teaching and learning for problem solving. For example, critical thinking and problem solving refers to the ability to make decisions, solve problems and take appropriate action, using learning processes such as conceptualizing, applying, analysing, synthesizing and/or evaluating information gathered by multiple means. Communication refers to the ability to synthesize and transmit ideas in both written, oral and virtual formats. Collaboration refers to the ability to work effectively with others using multiple communication means. Various OCW initiatives, such as those of the MIT (MERLOT) and Open University (OpenLearn) show that collaborative efforts are openly modified and enhanced by constituents of the network community, globally (Melsaac & Moreira, 2009).

Creativity and innovation refers to the ability to apply new ideas in developing innovative applications and solutions. Wikis, such as Wikispaces, WikiQuESD (Makrakis, 2014a; 2012b; 2010), and the latest versions of Pixie, Frames and Share, include collaboration options that allow synchronous collaborative learning. Such innovative applications are crossing spatial and temporal boundaries (Cummings, Espinosa, & Pickering, 2009). Blogging is another means for virtual communication (e.g. Edublogs, Blogger, & WordPress). Mind-mapping and concept mapping tools can become a great collaborative way in reflecting,

conceptualising, constructing and assessing knowledge (e.g. SpidererScribe, Wise Mapping, ChartTool, Cmap, Creately). These tools can boost learners' creativity and provide them with different ways to interconnect their thoughts as well as to accomplish metacognitive reflection skills. Similarly, tools for creating infographics (e.g. Wordle, Tableau, & InkSpace) engage students in actively discovering connections and develop creativity.

Figure 2 ICTs as enabling tools for the 10Cs



Source: Makrakis & Kostoulas-Makrakis, 2016

Connectivity addresses the complexity of the human-society-nature interaction, which can be significantly enabled by ICT-driven networking means. ICTs are still not affordable by the great majority of poor nations. In a recent report of the state of global connectivity (Internet.org, 2015), the unconnected are disproportionately located in developing countries: 78% of the population in the developed world is online compared to just 32% in emerging economies. Moreover, adoption of the Internet is slowing: the rate of growth declined for the fourth year in a row to just 6.6% in 2014 (down from 14.7% in 2010). According to the report, at present rates of decelerating growth, the Internet won't reach 4 billion people until 2019. It is concluded that, in order, for the entire world to connect to the Internet, there is an urgent need to address the three barriers to access: infrastructure, affordability and relevance.

Critical reflection refers to complex processes that strongly engage learners to critically reflect upon their reality, personal and social, and to transform it through action and reflection (Stanlick, 2014). Critical reflection goes beyond mere reflection, in that it requires the reflector to “deconstruct long-held habits of behaviour by looking beyond the behaviour itself to their own self-image and examining why they do what they do” (Silverman & Casazza, 2000: 239). In other words, when engaging in critical reflection, one should expose and critique one’s own values, experiences and habits of mind and those of the community in which one works, learns and lives. Cross/inter-cultural competence addresses learners’ capacity to communicate, collaborate and work in multicultural and global environments.

Co-responsibility refers to a culture of sharing that necessitates shifting to less egocentric principles and practices. Critical consciousness or conscientization in Freire’s (2000) terms denotes the process of developing a critical awareness of one’s social reality through reflection and action. Constructing knowledge represents an attempt to shift from consuming information to constructing knowledge. The critical 21st century skills enabled by ICTs merged with the 21st century learning pillars can be used as powerful means to transform school curricula towards sustainability justice.

4. Moving from Theory to Praxis through the DeCoRe Plus Model

The outlined issues of critical reflection, identity reconstruction, and critical consciousness, have become the driving forces for developing an ethical perspective to the conceptualisation and development of sustainability-just curricula. To enable pre-service and in-service teachers to develop the knowledge, critical skills and action competences necessary to understand sustainability justice in curricula requires a sense of agency and capacity to confront with personal (inner) frames and external (outer) structures that obstacle the conceptualisation and integration of sustainability justice in school curricula.

The DeCoRe plus methodology was developed to help prospective and in-service teachers at the Department of Primary Education at the University of Crete to embed sustainability justice in school curricula enabled by ICTs. DeCoRe plus is the abbreviation of Deconstruction-Construction-Reconstruction processes supplemented by those of Diagnostic Evaluation, Implementation and Summative Evaluation. The theoretical underpinning of the DeCoRe plus methodological approach derives from critical social theory, critical pedagogy and postmodern conceptions of teaching, learning and curriculum (e.g. Giroux, 2006 2004; 2002; 2000; Derrida, 2006; 1984; Mezirow, 2003; 2000; 1991; Freire, 2000; 1998ab; Habermas, 1990ab; 1971). It has been also drawn much on Freire’s concepts of dialogue, praxis (critical reflection) and conscientisation: the process of developing a critical awareness of one’s social reality through critical reflection and action. Other Freire’s concepts utilised in the DeCoRe plus, include codification and

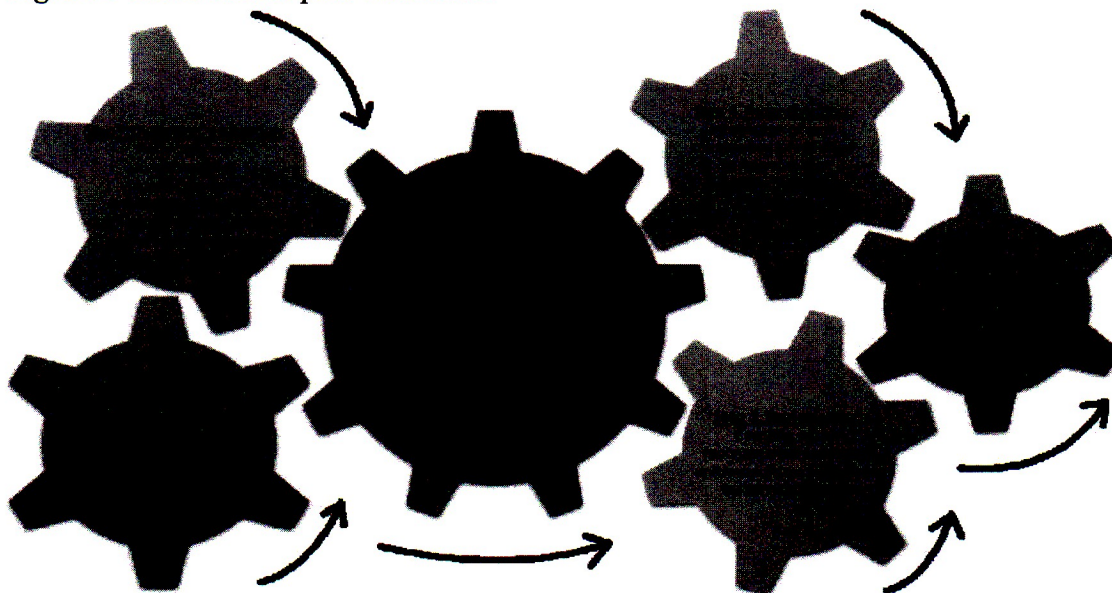
decodification. The first focuses on a process to build up a knowledge representation conveyed by symbolic means such as language, drawings, and pictures, and represents existential situations experienced by the target population in the situation and functions as a mediator between the theoretical and the practical contexts. The second is a process whereby the learners begin the interpretation of codifications by applying critique and a disposition for change (Freire, 1973ab; 1974).

Although the six DeCoRe plus processes follow a linear order (Table 2), each process is interconnected with each other to constitute a whole system (Figure 3).

Table 2 The DeCoRe plus processes

DeCoRe+ Processes	Key concepts in each process
<i>Diagnostic Evaluation</i>	Reflecting on: a) who we are; b) what we have (existing knowledge); c) where we want to go; and d) why we want to go there.
<i>Deconstruction</i>	Analysing critically the functioning of personal perspectives/habits of mind and chosen curriculum units/modules.
<i>Construction</i>	Gathering resources, creating ideas and constructing new meaning (perspectives).
<i>Reconstruction</i>	Integrating new constructed knowledge in line with the reconstructed frame of reference.
<i>Implementation</i>	Carrying out the reconstructed curriculum unit/module supplemented by service learning.
<i>Summative Evaluation</i>	Reflecting and evaluating on what has been learned and changed.

Figure 3 The DeCoRe plus interaction



The DeCoRe plus model has been applied in courses dealing with curriculum, sustainability justice and ICTs. The primary intention is to help pre-service teachers think through the lenses of critical pedagogy and sustainability justice as well as to construct multiple ways of knowing about teaching, learning and curriculum. Four key themes ran throughout the course. 1) Understanding teaching as an ethical and political praxis and the teacher as an active constructor of meaning, knowledge and curriculum. 2) Assessing curriculum as product, process and praxis. 3) Viewing curriculum in its close connection to purpose, intentions and ideology. 4) Developing pre-service teachers' sustainability justice literacy. These are reflected in Table 2, which is used as an organiser to discuss sustainability justice in teaching, learning and curricula. The organizer draws from Habermas's (1971) theory of the three constitutive knowledge interests and Sterling's (2001) four main functions of education (the socialization function, the vocational function, the liberal function, and the transformative function). Sterling sees the transformative function as central to achieving a more sustainable educational system. A large international study assessing 3,757 final year students' preferences toward these functions showed that there was a clear trend toward a preference to the transformative function that sees a university as an agent of change toward a fairer society and a better world (Makrakis & Kostoulas-Makrakis, 2013b).

Table 2 An organiser for discussing ways of knowing, roles, curriculum perspectives and teaching/learning pedagogies (based on Habermas, 1971, and Sterling, 2001).

Type of knowledge/ Human interest	Perceived role of education	Teaching and learning paradigms	Curriculum perspective	Pedagogy	Research paradigms
Technical (prediction; causality; instrumental; objective)	Socialisation (replicating society, culture and citizenship) Vocationalisation (preparing for employment)	Transmissive (transmitting facts, skills and values)	Product-oriented (prescribed, mandated and competence-based)	Behaviorism (focus on observable behavior rather than internal thought processes)	Positivism (predicting cause and effects; control of human behavior)
Practical (contextual; understanding; intersubjective)	Liberal (developing personal virtues, values, ethics and civic engagement)	Transactive (meaning making constructed through dialogue and interaction)	Process-oriented (experiential, flexible, reflective, dialogic, living text)	Constructivism (knowledge and meaning construction through interaction)	Interpretive (understanding of meaning; reality is constructed intersubjectively)
Emancipatory (self-reflective; subjective)	Transformative (developing a fairer society and a more sustainable world)	Transformational (altering learners' thinking and social reality)	Praxis-oriented (participatory, negotiated through action and reflection)	Critical pedagogy (merging self-reflection and understanding with a commitment to change)	Critical-transformative (dialectical, empowerment, committed to personal and social change)

In this context, teachers are increasingly called upon to switch from consumers and transmitters of knowledge towards taking an active role as curriculum developers, knowledge constructors and transformative learning agents enabled by ICTs. More specifically:

- ESJ (Education for Sustainability Justice) themes such as cultural diversity and intercultural understanding, health, HIV/AIDS, governance, natural resources, climate change, production and consumption, rural development, poverty can provide meaningful and challenging contexts for developing a wide range of ICT skills.
- ICT skills and tools such as concept mapping, modelling, social networking can provide a context and rationale for advancing ESJ themes, concepts, principles and methods that are conducive with transformative learning theories.
- OER and OCW content; open software tools; repositories of learning objects; and other learning resources, such as learner-support and assessment tools and online learning communities, can be used to enhance education for sustainability justice.

5. Initiating Self-transformation

In the DeCoRe plus diagnostic evaluation process, the central theme is reflecting on personal identity (who we are). This process is of particular importance, as self-transformation is prerequisite for getting involved in transforming teaching practices and curriculum as well as moving towards social transformation. In courses based on the DeCoRe plus model, pre-service teachers have the opportunity to critically reflect on their educational philosophy, especially as it relates to its consistency with praxis.

This process is facilitated by the administration of a survey at the beginning of the course to all pre-service teachers. The survey deals with the six representative educational philosophies: essentialism, perennialism, progressivism, pragmatism, existentialism and social reconstructionism. The outcome is presented and discussed in class by posing the following three key questions: 1) Which of these educational philosophies would you describe as authoritarian and non-authoritarian? 2) Does each of these philosophies relate to one or more worldviews; and what connections do you see among them? and 3) Which educational philosophy is most compatible with your own beliefs? Why?

The course prompts pre-service teachers to raise social critique of the current state of sustainability injustices, locally and globally; critically reflect on who they are; envision more positive and sustainable futures and the ways these can be realised in light with their educational philosophy. It is a process which transforms the way people relate to the current and future generations, and their connection to sustainability justice, by envisioning alternative futures.

Pre-service teachers collectively identify shared values, critically reflect and clarify their own values, describe the alternative futures for themselves and society. They are encouraged to actively participate in this process, through the following questions:

- What does a sustainable and desirable world look like?
- Which worldview, or shared human growth system, should predominate?
- How should we manage natural and human-made capital?
- What should the economy look like that is consistent with sustainability justice?
- What should characterize our interactions with natural environment, society, economy and culture?
- Which factors should weigh most heavily in our quality of life driven by sustainability justice?
- What should our societal priorities be in order to reflect sustainability justice?

Through this critical reflective/reflexive process pre-service teachers “rewrite their personal theories” and reinterpret some of their own perspectives and habits of mind based on new insights about their role as agents of change.

Critical reflection goes beyond mere reflection, to “deconstruct long-held habits of behaviour by looking beyond the behaviour itself to their own self-image and examining why they do what they do” (Silverman & Casazza 2000: 239). When pre-service teachers are engaging in critical reflection, they make explicit “who they are” and challenge their own basic assumptions and those of their community and society they live in. In this way, they are involved in a dialogue and critique of their own ideologies, perspectives and practices in teaching, learning and curriculum. The DeCoRe plus methodology entails investigating and reflecting on the roots of their personal theory as well as of their value system, prejudices, biases, assumptions, experiences, etc. – and how these ensure, or interfere with sustainability justice.

The self-transformation process starts from Derrida’s (2006; 1984) assumption that there must be a movement within the knowledge structures of a person in order to stimulate mental progress without completely breaking down the knowledge structures which already exist. Using this process, pre-service teachers are challenged to re-think what they have taken for granted or simply unquestioned. This leads to the destabilisation in the pre-service teachers’ comfort zones.. Such a process can be seen as thinking outside the limits (box), which stimulates and forces pre-service teachers to think beyond the borders of their identity construction.

Through this process, pre-service teachers are able to understand the reasons for their way of knowing, thinking and behaving in order to know what should change, how to change it, as well as the reason why it should be changed. To facilitate pre-service teachers' self-transformation, some key points are taken into consideration, such as: creation of a respectful environment for dialogue; connecting intentions and actions with impacts; be positive to external critique, honesty and good

listening; avoidance of defensive attitudes in others' critique; acceptance of responsibility and co-responsibility; and the will to "reconstruct oneself".

6. Deconstructing Curriculum Units/Modules

The self-transformation process experienced in the previous step paves the way for pre-service teachers to get involved in deconstruction of the curriculum unit chosen. The DeCoRe plus deconstruction process includes six domains: 1) content; 2) methods of assessment; 3) gaps, silences and undergird assumptions; 4) power and interests; 5) dominated perspectives and versions of reality; 6) the image and values portrayed and transmitted by the unit/module author(s).

In each of these domains, questions are posed to guide and facilitate the deconstruction process with particular reference to the assessment of the unit/module under deconstruction in terms of its aims and objectives, coherence between aims, objectives and learning activities, connectivity to real-life, the four pillars of sustainable development, the six learning goals, the 10Cs, the 17 SDGs, interdisciplinarity and problem-based learning. Pre-service teachers are encouraged to discover:

- The values in the unit/module that are supposed to be taught but they are implicit.
- Whether the unit/module reproduces the dominant ideology and the economic model of non-sustainable economic growth.
- Whether learners are enabled/empowered/emancipated/liberated or limited/deskilled/oppressed.
- The positions, voices and interests that are at play in the unit/module.
- The views that are excluded or privileged in the unit/module.
- How learners are assessed; the authenticity of the evaluation methods and of the knowledge assessed.
- The extent to which the curriculum allows for the social construction of meanings by the learners.
- The nature of the social relations embodied in the classroom activities; the epistemological assumptions undergird in the curriculum units/modules (knowledge as technical/instrumental; practical and emancipatory).
- What values are explicit and implicit within the curriculum.
- The aspects of culture or knowledge the curriculum promotes; democratic accountability and decision-making.
- Whether the curriculum promotes or restricts critical reflectivity, action learning and problem solving.
- If learners are given the opportunity to learn concepts, principles, ideas and values that are not registered with the official curriculum.
- If there could be knowledge and activities considered necessary in the unit/module, but not included and identify what prevents the learner to learn

something that would otherwise be useful in learning about the specific teaching/learning unit/module.

- What is missed or silenced from the unit/module content.

In the deconstruction process particular emphasis is given to issues related to power and interests. Pre-service teachers are required to identify whose interests/views are raised in this teaching/learning unit/module and why; what interests/views are hidden or silenced and whether the alleged views in the teaching/learning unit/module are objective and just. They are also encouraged to uncover the image of the world that is conveyed through the teaching/learning unit/module; which side of social reality is depicted; what is real and what is imaginary and what are the analogues of the subject in other places/areas. Finally, the pre-service teachers are looking for the aspects of life/world the author/s value and contrast them with the extent to which they are similar to or different from the views they hold or others.

7. Construction Process

The deconstruction process is often followed by the reconstruction. However, there is a need to place in the middle a construction process, which functions as a link between the two. The construction process consists of two key parts. In the first, pre-service teachers are asked to assess the implications that the deconstruction outcomes entail to the reconstruction of the curriculum unit/module. In the second, they are asked to select and define appropriate materials, methods, strategies, media and ICTs that reflect the deconstruction outcomes. At this step, particular emphasis is given to what is needed for the reconstruction of the curriculum unit/module and ensure the integration of sustainability justice in the reconstructed curriculum. ICT tools, multimodal texts, collaborative concept mapping and interactive whiteboard (IWB) applications have been the focus of technologies used supplemented by OER and OCW. For example, through Google Earth, pre-service teachers construct global hunger/poverty/child mortality maps to enhance current understanding of the global distribution of such injustices and the geographic and biophysical conditions of people facing them. Similarly, Google Earth has been used for tracking environmental changes, deforestation, child labour, digital gaps, violation of human rights, and other sustainability issues. They also construct learning materials using extensively Open Education Resources (OER) freely accessible on the Internet.

8. Reconstruction Process

In the process of reconstruction, the pre-service teachers realise their own agency in reconstructing curriculum. They are also given the chance to reflect on “who they have become”, contrasted to “what they were” at the beginning of the

deconstruction process. They are, thus, involved in discussing what has been changed in their own identity through their learning journey and experience in the course applying DeCoRe plus. Simultaneously, they start putting together all the pieces of the new curriculum elaborated in the construction process, focusing on sustainability issues such as climate change, poverty, violence, hunger, child labour, sexism, pollution, worker exploitation, corporate exploitation, energy shortage, inadequate health care, unemployment, human trafficking, terrorism, and inequality. Thus, they make use of methods demanding inquiry, argumentation, multiple perspectives and service learning strategies. The reconstructed curriculum unit is highly infused by teaching, learning, and research resources (e.g. OER and OCW) that reside in the Web-based public domain or have been released under an intellectual property license that permits their free use.

Connecting to Freire's (2000) idea of emancipatory knowledge and critical consciousness, the infusion of sustainability justice in curricula, both as theory and practice, through the DeCoRe plus methodology, is driven by a critical perspective that aligns with and integrates the principles of critical pedagogy. Pre-service teachers are encouraged to reflect on what has been changed in their own conceptions of teaching, learning and curriculum and the meanings that these changes entail to personal worldviews and actions. This process is facilitated by the administration of a post-survey using the same questionnaire dealing with education philosophies that was given at the beginning (diagnostic evaluation) and a critical reflection on its outcomes.

9. Conclusion

Our world, locally and globally, is facing considerable injustices and challenges that education cannot and should not ignore. Remaining indifferent or neutral means a lack of co-responsibility to the continuing of sustainability injustices. Throughout the 20th century, education played a reproductive role rather than a transformative role due to a system that favoured mainly knowledge transmission and standardised assessment (Makrakis, 2014b). Developing the DeCoRe plus for embedding sustainability justice in school curricula enabled by ICTs and driven by critical pedagogy was seen as an alternative curriculum approach to the ones that maintained and perpetuated an unjust world.

Pre-service teachers in the courses where DeCoRe plus has been tried out are involved in a curriculum discourse that focuses on their experience on tackling real-life problems. Unlocking Web-enabled ICTs to embed sustainability justice in school curricula is a challenge to the prevailed curricula that are structured within a transmissive learning framework. Technology is a crucial part of what is happening in the classroom, but it is critical to remember that pedagogy must prevail (Makrakis & Kostoulas-Makrakis, 2012). The DeCoRe plus methodology leads to transformative praxis as it involves participants in the process of defining what to do and how to do, acquiring ownership in what they do, and getting involved in a

learning process that can empower them to transform their personal and social realities. Our experiences show that pre-service teachers recognise the emancipatory role of ICTs when such technologies are used for advocacy and empowerment, especially for those facing injustices and inequities. The advantages provided by interactive technologies, such as IWBs and PV (participatory video) make sense when they are driven by sound pedagogies. Pre-service teachers are also provided with opportunities to make learning more authentic by giving them the ability to contextualise learning and expanding their opportunities for equitable participation in the learning process. They also experience a new dimension of collaborative learning that is highly enhanced by a new perception of time, space and learning. Applying the DeCoRe plus methodology, pre-service teachers are empowered to participate in the organisation of their own learning process that is highly enriched by OER and OCW freely available online. Learning opportunities are also being expanded both at the class and home domains without the constraints of fixed time and place. They also learn that it is not only important and critical to understand change, but it is also equally or even more important in making positive change.

Although pre-service teachers practicing the DeCoRe plus methodology may leave their undergraduate studies with strong knowledge on sustainability justice, they also may face difficulties as in-service teachers struggling to develop sustainability-just curricula. As pointed by Agarwal (2011) in the case of teaching social studies for social justice, pressures and constraints, such as mandated curricula and standardised tests, may require novice teachers to negotiate what they want to teach with what they are able to teach. Eidson (2015: 2) stresses that “it is more important than ever to recognize the importance of providing pre-service teachers with an understanding of how to translate theory into practice, elucidating for them the complexities in translating a social justice vision into a context of accountability and standardization”. Sustainability justice education demands committed teachers to challenge pressures and constraints in their effort to develop a sustainable and just society.

REFERENCES

- American Management Association (2010). Critical skills survey. Retrieved 13 April 2012 from <http://www.amanet.org/organizations/2010-survey-critical-skills.aspx>
- Agarwal, R. (2011). Negotiating visions of teaching: Teaching social studies for social justice. *Social Studies Research and Practice*, 6(3), 52–64.
- AT21CS (2012). What are 21st-century skills? Retrieved 8 November 2012, from <http://atc21s.org/index.php/about/what-are-21st-century-skills/>
- Bonorris, S. (2010). Environmental justice for all: A fifty state survey of legislation, Policies and Cases. *American Bar Association and Hastings College of the Law*. Retrieved 22 March 2015, from <http://gov.uchastings.edu/public-law/docs/ejreport-fourthedition.pdf>

- Cummings, J. N., Espinosa, J. A., & Pickering, C. K.. (2009). Crossing spatial and temporal boundaries in globally distributed projects: A relational model of coordination delay. *Information Systems Research*, 20(3), 420–439.
- CARDET (2014). *Technology justice, millennium development goals – Global learning teacher's guide for the 'Make the Link' project*. Research and Development Centre CARDET.
- Delors, J. et al. (1996). *Learning: The treasure within*. Paris: UNESCO.
- Derrida, J. (1984). Deconstruction and the other. An interview with Jacques Derrida. In R. Kearney (Ed.), *Dialogues with contemporary continental thinker*. Manchester: Manchester University Press.
- Derrida, J. (2006). Is there a philosophical language? In L. Thomason (Ed.), *The Derrida–Habermas Reader*. Edinburgh: Edinburgh University Press.
- Eidson, K. (2015). Incorporating social justice in the pre-service teacher classroom. *Journal of Education and Human Development*, 4(2), 1–9.
- Food and Agriculture Organization (2014). The state of food insecurity in the world: Strengthening the enabling environment for food security and nutrition. Rome: FAO. Retrieved 22 March 2015, from <http://www.fao.org/publications/sofi/2014/en/>
- Freire, P. (1998). *Pedagogy of freedom: ethics, democracy, and civic courage*. New York: Rowman & Littlefield.
- Freire, P. (2000/1970). *Pedagogy of the oppressed*. New York: Continuum.
- Freire, P. (1973a). Education as a practice of freedom. In P. Freire, *Education for critical consciousness*. New York: Seabury Press.
- Freire, P. (1973b). Extension or communication. In P. Freire, *Education for critical consciousness*. New York: Seabury Press.
- Giroux, H. (2006). Public pedagogy and the politics of neoliberalism: Making the political more pedagogical. In A. Dirlik (Ed.), *Pedagogies of the global* (pp. 59–75). Boulder, CO: Paradigm.
- Giroux, H. A. (2004). *The terror of neoliberalism: Authoritarianism and the eclipse of democracy*. Boulder, CO: Paradigm.
- Giroux, H. (2002). Neo-liberalism, corporate culture and the promise of higher education: The University as a democratic public sphere. *Harvard Educational Review*, 72(4), 425–464.
- Giroux, H. A. (2000). *Stealing innocence: Corporate culture's war on children*. New York: Palgrave.
- Giroux, H. A. & McLaren, P. (1996). Teacher education and the politics of engagement: The case for democratic schooling. In P. Leistyna, A. Woodrum, & S. A. Sherblom (Eds.), *Breaking free: The transformative power of critical pedagogy* (pp. 301–331). Cambridge, MA: Harvard Educational Review.
- Giroux, H. (1988). *Teachers as intellectuals*. Boston, MA: Bergin & Garvey.
- Grant, C., & Agosto, V. (2008). Teacher capacity and social justice in teacher education. In M. Cochran-Smith, S. Feinman-Nemser, J. McIntyre, & K. Demers (Eds.), *Handbook of research on teacher education: Enduring questions in changing contexts* (pp. 176–200). Mahwah, NJ: Lawrence Erlbaum.
- Habermas, J. (1990a). *The philosophical discourse of modernity – Twelve lectures*. Cambridge, MA: MIT Press.
- Habermas, J. (1990b). *Moral consciousness and communicative action*. Oxford: Polity Press.
- Habermas, J. (1971). *Knowledge and human interests*. London: Heinemann.

- Hayes, S., & Jandrić, P. (2014). Who is really in charge of contemporary education? People and technologies in, against and beyond the neoliberal university. *Open Review of Educational Research*, 1(1), 193–210.
- Huckle, J. (2012). Teacher education for sustainability in network society: Combining digital and sustainability literacies. *Journal of Teacher Education for Sustainability*, 14(2), 128–143.
- Jandrić, P. (2011). In and against radical monopoly: critical education and information and communication technologies. *Problems of Education in the 21st Century*, 35(1), 70–84.
- Internet.org (2015). The state of global connectivity. Retrieved 12, December, 2015, from <http://newsroom.fb.com/news/2015/02/the-state-of-global-connectivity/>
- Makrakis, V., & Kostoulas-Makrakis, N. (2005). Techno-sciences and mathematics: Vehicles for a sustainable future and global understanding. *Proceedings of the 2nd International Conference on Hands on Science. HSci 2005* (pp. 103–108). Heraklion: University of Crete.
- Makrakis, V., & Kostoulas-Makrakis, N. (2016). Bridging the qualitative-quantitative divide: Experiences from conducting a mixed methods evaluation in the RUCAS programme. *Evaluation and Program Planning*, 54, 144–151.
- Makrakis, V., and Kostoulas-Makrakis, N. (2015). A strategic framework for developing interdisciplinary minors on climate change and sustainability policy: The CLIMASP-Tempus example. In W. Leal Filho et al. (eds.), *Integrating sustainability thinking in science and engineering curricula* (pp. 103–114). Dordrecht: Springer.
- Makrakis, V., & Kostoulas-Makrakis, N. (2014). An instructional-learning model applying problem-based learning enabled by ICTs. In A. Anastasiadis et al. (Eds.), *Proceedings of the 9th Panhellenic Conference on ICTs in Education* (pp. 921–933), 5–7 October, University of Crete.
- Makrakis, V. (2014a). ICTs as transformative enabling tools in education. In R. Huang, Kinshuk, & J. Price (Eds.), *ICT in education in global context* (pp. 101–119). Berlin: Springer.
- Makrakis, V. (2014b). Transforming university curricula towards sustainability: A Euro-Mediterranean initiative. In K. Tomas & H. Muga (Eds.), *Handbook of research on pedagogical innovations for sustainable development* (pp. 619–640). Hershey, PA: IGI Global.
- Makrakis, V., and Kostoulas-Makrakis, N. (2013a). Sustainability in higher education: a comparative study between European Union and Middle Eastern universities. *International Journal of Sustainable Human Development*, 1(1), 31–38.
- Makrakis, V., & Kostoulas-Makrakis, N. (2013b). A methodology for reorienting university curricula to address sustainability: The RUCAS-Tempus project initiative. In S. Caeiro et al. (Eds.), *Sustainability assessment tools in higher education institutions* (pp. 23–44). Dordrecht: Springer. DOI: 10.1007/978-3-319-02375-5_18
- Makrakis, V. (2006). *Preparing United Arab Emirates teachers for building a sustainable society*. E-Media Publications, University of Crete.
- Makrakis, V. (2010). The challenge of WikiQuESD as an environment for constructing knowledge in teaching and learning for sustainable development. *Discourse and Communication for Sustainable Education*, 1(1), 50–57.
- Makrakis, V. (2012a). Scientific and technological progress, political beliefs and environmental sustainability. *Discourse and Communication for Sustainable Education*, 3, 63–74.

- Makrakis, V. (2012b). Reorient teacher education to address sustainable development issues through the WikiQuESD. In A. Jimoyiannis (Ed.), *Research on e-Learning and ICT in Education* (pp. 83–94). London: Springer.
- Makrakis, V., & Kostoulas-Makrakis, N. (2012). The challenges of ICTs to online climate change education for sustainable development: The ExConTra learning paradigm. In S. A. Anwar (Ed.), *Proceedings of the 5th Conference on eLearning Excellence in the Middle East – Sustainable Innovation in Education* (pp. 594–605). Dubai: Hamdan Bin Mohammed e-University.
- Mezirow, J. (1991). *Transformative dimensions of adult learning*. San Francisco, CA: Jossey-Bass.
- Mezirow, J. (Ed.). (2000). *Learning as transformation: Critical perspectives on a theory in progress*. San Francisco, CA: Jossey-Bass.
- Mezirow, J. (2003). Transformative learning as a discourse. *Journal of Transformative Education*, 1(1), 58–63.
- Partnership for 21st Century Skills (2012). Retrieved 13 April, 2012, from <http://www.p21.org/index.php>
- Peters, R. T. (2014). *Solidarity ethics: Transformation in a globalised world*. Minneapolis, MN: Fortress Press.
- Silverman, S. L., & Casazza, M. E. (2000). *Learning and development: Making connections to enhance teaching*. San Francisco, CA: Jossey-Bass.
- Stanlick, S. (2014). Leveraging technology for critical reflection and service learning. Retrieved 4 July 2014, from <http://www.elon.edu/docs/eweb/org/nccc/Leveraging%20Technology.pdf>
- Sterling, S. (2001). *Sustainable education: Re-visioning learning and change*. Schumacher Society Briefing no. 6. Dartington: Green Books.
- UNESCO. (2002). UNESCO promotes new initiative for free educational resources on the internet. Retrieved 10 December 2015, from http://www.unesco.org/education/news_en/080702_free_edu_ress.shtml
- UNICEF (2015). The state of the world's children. Executive summary re-imagine the future Innovation for every child. Retrieved 4 July 2014, from http://www.unicef.org/publications/files/SOWC_2015_Summary_and_Tables.pdf
- WCED (1987). *Our common future (The Brundland Report)*. Oxford: World Commission on Environment and Development/Oxford University Press.