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# PROCESSES, STRATEGIES AND PRACTICES FOR TURNING THE UNIVERSITY OF CRETE INTO A SUSTAINABLE UNIVERSITY

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## Abstract

*In this paper, we look at the University of Crete experience to integrate the concept of sustainable development across all its operations. Through a review of current sustainability practices of universities worldwide, this paper has identified a number of principles for developing a sustainable university. These principles are then used as a framework for analysing the sustainable initiatives being implemented at the University of Crete in the context of the Reorient University Curricula to Address Sustainability (RUCAS) project – an EU-Tempus initiative. This effort has been backed-up by two research studies, which indicate the urgent need for institutionalising sustainability across all university functions.*

***Key words:*** *sustainable university, RUCAS, Tempus, the University of Crete, education for sustainability*

## Introduction: The quest for sustainability in higher education

In recent times, the world is facing a series of sustainability challenges, including extreme poverty, racism, unfair trade, climate change, loss of biodiversity, violation of human rights and so on. For the purposes of this study 'sustainability' is defined broadly as "making informed, contextual and conscious decisions driven by the principles of solidarity, justice, accountability, equity and transparency for the good of present and future generations, locally and globally and acting upon those decisions for advancing social, economic and environmental wellbeing" (Makrakis, 2011, p. 411). Given the complex nature of the sustainability challenges and the concept of sustainability, it becomes imperative that education should play a critical role in the promotion of 1) social and economic justice; 2) ecological integrity and 3) the well-being of all living systems on the planet. *Agenda 21*, the international action plan drawn up at the United Nations (UN) Conference on the Environment and Development and its followed up UN Conference Rio+20 identified education as a catalyst to building a more sustainable future driven by these three imperatives. The concept of education for sustainability could be broadly defined as "the learning needed to maintain and improve our quality of life and the quality of life of generations to come. It is about equipping individuals, communities, groups, businesses and government to live and act sustainably, as well as

giving them an understanding of the environmental, social and economic issues involved" (Makrakis, 2011, p. 411).

In line with this, many universities around the world have taken initiatives to make their campuses more sustainable (Leal Filho, 2010ab). One important initiative is the Talloires Declaration initiated by the Association of University Leaders for a Sustainable Future that has been signed by over 350 university presidents and chancellors in over 40 countries. Other initiatives include the Kyoto Declaration of the International association of Universities, the Copernicus Charter of the European Association of Universities and the Luneburg Declaration. However, with a few exceptions, the majority of the declarations and action plans have never been fully implemented (Leal Filho, 2011). Despite all sustainability initiatives implemented in universities, colleges and technological institutions around the world, only a few have included sustainability in their mission statement (Velázquez, Mungia, Platt, & Taddei, 2006), and a few successful examples of comprehensive large-scale curriculum change related to sustainability can be evidenced (Harpe & Thomas, 2009; Makrakis, 2012a). It is also evident that most universities are tackling sustainability issues in a compartmentalised manner, where sustainability is confined to specific courses, often isolated from research and other campus operations (Mcmillin & Dyball, 2009).

Our internet-based review of more than 30 universities in the United States of America and Europe regarding their initiatives towards sustainability revealed that an increasing number of leading universities have committed themselves to take actions towards a sustainable university. However, although they do recognise more inclusive definitions of sustainability, in practice issues of economic and social sustainability are in the margin. The focus is placed on environmental issues, such as investing in greener buildings, greener practices and products, reducing waste, saving energy and water and to a lesser extent on ways of engaging staff and students in curriculum revision to address sustainability. The role of staff and students in helping to establish more environmentally and sustainable universities is the key driver that cannot be underestimated. It is promising, however, that a smaller but increasing number of universities infuse and/or introduce courses and units in the form of minors, majors and graduate degrees dealing with sustainability studies. Universities can optimise their role as drivers for change with regard to sustainability by adopting a 'whole-of-university' approach. This approach explicitly links research, educational, operational and outreach activities that are key components of a sustainable university (Mcmillin & Dyball, 2009).

## The constituencies of a sustainable university

Together with the involvement of universities in sustainability actions, worldwide discussions have been initiated in defining the constituencies of a sustainable university. The discussions have been linked to questions concerning the transformative role and function of universities. Transforming universities into more sustainable institutions necessitates rethinking of what we are doing on essentially four key university functional and interlinked constituencies: a) curriculum, teaching and learning; b) research and development; c) institutional/administrative operations and d) partnerships and outreach. These are driven by the three realms of sustainable development: 1) social and economic justice; 2) ecological integrity and 3) the well-being of all living systems on the planet through an integrative and cross-cutting manner (Figure 1).

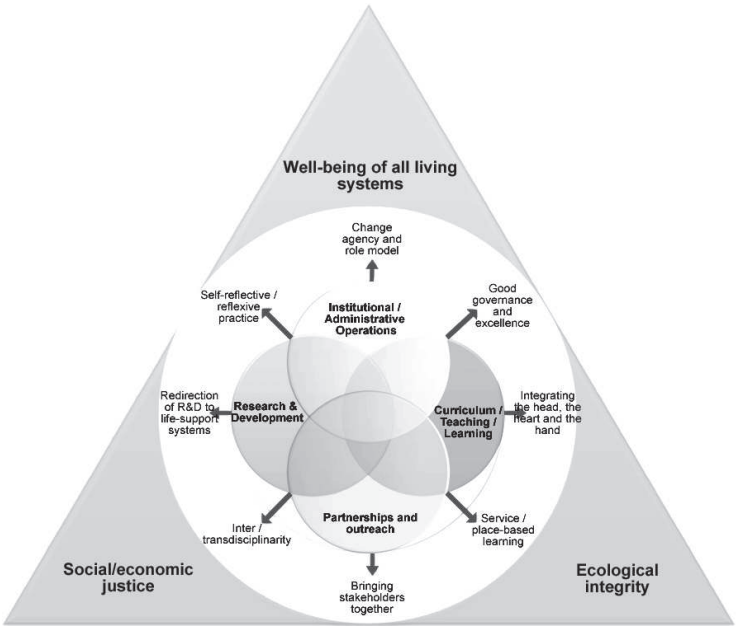



Figure 1. The constituencies of a sustainable university

## *Curriculum, teaching and learning*

When it comes to curriculum, as Sterling (2004) maintains, sustainability is not just another issue to be added to an overcrowded curriculum, but a gateway to a different view of curriculum, of pedagogy, of organisational change, of policy and particularly of ethos. Sustainability issues can be implemented within the curriculum, using three different strategic decisions: 1) creating new courses, minors, majors and postgraduate degrees specific to sustainability; 2) revising existing courses to include new course content addressing sustainability and 3) integrating experiential, constructivist and transformative (ExConTra) teaching and learning methodologies in both new and revised courses to address sustainability. The ExConTra learning paradigm is associated with educational approaches such as inquiry and discovery-based learning, service learning, place-based learning and reflective/reflexive learning, all of which are associated with teaching methods and strategies that are suitable to education for sustainability (Makrakis & Kostoulas-Makrakis, 2012). For instance, place-based learning and instruction is primarily intended to motivate through a humanistic and scientific engagement with outdoor and field-based activities on local sustainability issues (Ault, 2008; Gruenewald & Smith, 2008; Smith & Sobel, 2010). Similarly, service-learning is a teaching and learning method that connects meaningful, community service experiences with academic learning, personal growth and civic responsibility (Shumer & Duckenfield, 2004; Simons & Cleary, 2005). Both of these methods are values-driven approaches, designed to advance experiential, constructivist and transformative learning goals together with locally identified social, economic and environmental objectives. Inquiry-based learning is often described as a cycle or a spiral, which implies formulation of a question, its investigation, data analysis and creation of a solution. It also provides opportunities for students to develop

real-life skills; learn to cope with controversial problems as well as deal with changes and challenges (Alberta Learning, 2004). Discovery learning is an inquiry-based method that takes place in an experience-based problem-solving situation, where the learner is confronted with an open-ended, ill-structured and authentic (real-world) problem (Hai-Jew, 2008; Balım, 2009; Alfieri, Brooks, Aldrich, & Tenenbaum, 2011). It is associated with cooperative learning, with instructors acting as facilitators rather than transmitters of information. Such a method is also connected to case-based learning, where students analyse case studies of historical or hypothetical situations that get involved in solving problems and/or making decisions (Carroll & Borge, 2007; Lee, Lee, Liu, Bonk, & Magjuka, 2009). All of these methods are based on the principle that students experience, construct and transform their own versions of reality rather than simply absorb versions presented by others. From a sustainability perspective, these methods help to transform unsustainable actions and reconnect people to the natural and cultural world of which they are an organic part.

### *Research and development*

Research and development is a critical function in higher education institutions. Tackling the sustainability challenges implies a redefinition of mainstream research and development policies that contributed to the degradation of the natural world. An emphasis should be placed on the transformative dimension of research as sustainable development can only be realised through a far-reaching transformation of the situation humankind finds itself in at the beginning of the third millennium (Jaeger, Tabara, & Jaeger, 2011). New dynamics that have emerged in higher education in the past decade due to the sustainability challenges and the universities' involvement in various global sustainable development initiatives have helped to start redefining research and development. Such trends are more visible to establishing collaboration with community and industry/corporations, the collaboration between research centres within and between other universities, opening positions for PhD research dealing with sustainability issues and so forth.

### *Institutional and administrative operations*

Another major area of change would have to be institutional and administrative operations. The university administration has a very significant impact on both the academic and organisational/operational decisions that include curricula, academic programmes, building design, operations and maintenance, recycling, waste and energy, including issues related to ensuring the health, safety and well-being of staff and students, professional incentives and so forth. Most of the universities that have endorsed international declarations and initiatives for turning their institutions into sustainable universities have established centres or offices of sustainability that are charged with the coordination of their efforts.

### *Partnerships and outreach*

Although educational institutions are often criticised for not opening their doors to the community, those involved in education for sustainability have taken initiatives to bridge

the gap. Universities are now being challenged to respond to local, regional and global environmental and societal challenges when approaching sustainable development. A growing trend on community-university partnerships in research, learning and knowledge mobilisation is evident around the world. The last ten years have therefore seen a stepping up of activities relating to partnerships and outreach for sustainability. Worthy of attention are the United Nations University (UNU) accredited regional centres of expertise (RCE) which focus on partnership learning and action for sustainability, as well as the UNESCO Chairs' Network on Education for Sustainable Development.

## The case of the University of Crete

### *Background: The University of Crete*

The University of Crete (UOC) established in 1973 is the principal higher education institution on the island of Crete, Greece, and one of the most academically reputable ones, ranked amongst the top 500 universities in the world. It is a multi-disciplinary, research-oriented institution, located in the cities of Rethymnon and Heraklion. Since its establishment, it has developed considerable research activity and has undertaken innovative initiatives that reflect its dynamic development. The University of Crete has 13 141 students (11 011 at the undergraduate level and 2 130 at the postgraduate level), more than 900 faculty members and researchers as well as approximately 240 administrative staff on both campuses. The University of Crete in the Session of the Council of all Greek Universities' Rectors has jointly undersigned the Charter of Greek Sustainable Universities that embraces the principles of sustainable development, international treaties and the results of international conventions and is committed to promote the infusion of sustainable development in the Greek universities. In 2008, a UNESCO Chair on ICT in Education for Sustainable Development was established at the University of Crete. The Chair has taken initiatives to establish a North-South Network, including various university institutions to promote sustainability. It has also initiated the establishment of the RCE Crete, (Regional Centre of Expertise on ESD) acknowledged by the UNU.

### *Mapping up the current situation*

In turning the University of Crete into a sustainable university, a first attempt was to map out what the current situation is in terms of what knowledge, skills and values/attitudes concerning sustainability students of various disciplines get from their study programmes and, second, to review the processes and practices undertaken at the University of Crete with respect to sustainable development. The results presented in this paper are based on two surveys. The sample of the first survey comprised 790 students from four faculties carried out in the 2010/2011 academic year. The second survey comprised 189 final year students from the Department of Primary Education in the context of a RUCAS – Tempus project in the academic year 2011/2012.

One of the key issues studied in the first survey was concerned with students' anthropocentric and biocentric attitudes. Anthropocentrism literally means human-centred, whereas biocentrism means life-centred. Anthropocentric individuals assign intrinsic value to humans alone or assign a significantly greater amount of intrinsic

value to humans than to non-human species (Curry, 2006; Brennan & Lo, 2008). Statements such as: *Environmental problems can be solved by advances in technology or through the protection of wealth in a free market* and *by a better redistribution of wealth and by changes in our life style* all fall into a materialist and anthropocentric attitude since they give primacy to human activity. From this perspective, non-human beings are important only to the extent that they affect humans or can contribute to human well-being. To put it simply, individuals driven by anthropocentric values tend to see the physical environment as a means to support their materialist needs (Curry, 2006). This is in contrast to individuals who bear biocentric values and extend moral values to non-human species, ecosystems as well. The anthropocentric-biocentric attitudinal scale used in this study was adapted from Haigh (2007) and has similarities with the New Environmental Paradigm questionnaire (Dunlap, Kent, Van Liere, Mertig, & Jones, 2000). The final scale consisted of 14 variables out of 20 initially constructed with a *Cronbach's reliability* $\alpha$ equal to 0.77 (Table 1). Responses were coded as 'strongly disagree' = 1, 'disagree' = 2, 'uncertain' = 3, 'agree' = 4 and 'strongly agree' = 5. The social-psychology literature on behavioural research has established attitudes as important predictors of behaviour, behavioural intentions and explanatory factors of variants in individual behaviour (Eilam & Trop, 2012).

Table 1. The Cronbach's reliability test results for anthropocentric-biocentric attitudes

| Anthropocentric and biocentric variables | Scale mean | Scale variance | Corrected it/to cor | Squared mult. cor | Cronbach's alpha |
|---|---|---|---|---|---|
| | If item deleted | | | | |
| V1 | 36.03 | 70.14 | 0.267 | 0.174 | 0.767 |
| V2 | 36.76 | 66.16 | 0.411 | 0.275 | 0.754 |
| V3 | 36.91 | 65.21 | 0.403 | 0.246 | 0.755 |
| V4 | 36.75 | 64.80 | 0.443 | 0.233 | 0.751 |
| V5 | 37.36 | 65.12 | 0.461 | 0.277 | 0.749 |
| V6 | 36.69 | 63.75 | 0.473 | 0.261 | 0.747 |
| V7 | 36.86 | 65.97 | 0.465 | 0.240 | 0.750 |
| V8 | 37.43 | 65.10 | 0.512 | 0.332 | 0.745 |
| V9 | 37.33 | 63.43 | 0.549 | 0.372 | 0.742 |
| V10 | 36.02 | 70.80 | 0.214 | 0.163 | 0.771 |
| V11 | 37.26 | 64.10 | 0.530 | 0.367 | 0.743 |
| V12 | 36.29 | 68.95 | 0.285 | 0.118 | 0.766 |
| V13 | 36.30 | 70.74 | 0.188 | 0.092 | 0.775 |
| V14 | 35.77 | 72.45 | 0.152 | 0.116 | 0.775 |

Another important composite variable studied in the first survey was concerned with sustainability actions, which are hypothesised to be related to sustainability attitudes. Ten sustainable actions were selected mostly referring to environmental sustainability. The actions included energy saving, purchase of environmentally friendly products, buying local products, donations and voluntarism. Responses are coded as 'never' = 1, 'sometimes' = 2, 'often' = 3, and 'very often' = 4. A *Cronbach reliability* analysis was performed, which revealed a score of $\alpha = 0.72$ (Table 2). The relationship between

attitudes and actions (behaviour) has been well discussed since the 1980s. Much of the research in this area is built on the 'theory of reasoned action' and 'planned behaviour' (Ajzen, 1991, 2002). Central to this theory is the idea that individuals possess an array of personal values, and each of these values is held with differing ranks or weights which serve as criteria for judging the suitability of particular behaviours. For instance, an individual who strongly agrees with the strong anthropocentric statement that *human beings have the right to exploit Nature for their own profit* is expected to be less likely engaged with conservation actions or behaviours (for instance, energy saving, purchase of environmentally friendly products) than an individual who strongly disagrees with the statement, assuming other characteristics are identical. In this example, the statement represents a value or belief that humans are in the centre (anthropocentrism) and the degree of agreement or disagreement measures the attitude strength and consequently may function as a predictor to future behaviour. This ethic or value also assumes that the earth's resources are perceived as unlimited and can be either replaced naturally and/or tackled through technological advances. This is in contrast to a sustainable ethic which assumes that humans are a part of the natural environment and that they feel unhappy when the natural ecosystem is violated. The important role of the acquisition of sustainable behaviour is often explained by the assumption that changes in sustainable behaviour on a personal level can lead to changes in sustainability on a societal level (Eilam & Trop, 2012). A biocentric orientation towards the environment will thus result in a higher level of pro-environmental intentions than anthropocentric attitudes.

Table 2. The Cronbach's reliability test results for sustainable actions

| Sustainable actions | Scale mean | Scale variance | Corrected it/to cor | Squared mult. cor | Cronbach's alpha |
|---|---|---|---|---|---|
| | If item deleted | | | | |
| V1 | 21.89 | 19.17 | 0.394 | 0.324 | 0.694 |
| V2 | 21.85 | 18.93 | 0.432 | 0.334 | 0.687 |
| V3 | 21.85 | 20.44 | 0.297 | 0.097 | 0.711 |
| V4 | 21.46 | 21.17 | 0.192 | 0.044 | 0.730 |
| V5 | 21.51 | 20.43 | 0.356 | 0.212 | 0.700 |
| V6 | 21.90 | 19.91 | 0.496 | 0.289 | 0.680 |
| V7 | 21.56 | 19.52 | 0.533 | 0.376 | 0.673 |
| V8 | 21.66 | 19.39 | 0.483 | 0.316 | 0.679 |
| V9 | 21.87 | 21.20 | 0.303 | 0.124 | 0.707 |
| V10 | 22.40 | 20.81 | 0.356 | 0.193 | 0.700 |

In the second survey, a sample of 187 students from the final year of their studies in the Department of Primary Education taken randomly from those attending obligatory classes participated in the RUCAS – Tempus international survey of 11 universities with a total sample of 3 757 students (Makrakis, Kostoulas-Makrakis, & Kanbar, 2012). In this paper, we will focus on the variable dealing with Sterling's four-type typology of preferences towards the role and function of university. Sterling (2001) poses three central questions in this context: *What is education for? What is education?* and *Whose education?* In relation to the first and second questions, Sterling contributes to that debate by suggesting four functions or roles of education: 1) to replicate society and

culture and promote citizenship (*the **socialisation** function*); 2) to develop students' full potential (*the **liberal** function*); 3) to prepare students for the labour market (*the **vocational** function*) and 4) *to encourage change towards a fairer society and better world (the **transformative** function)*. Sterling suggests that sustainable education is about reconciling all four functions, but stresses that a transformative paradigm which values, sustains and realises human potential is of critical importance (Srerling, 2004, 2008). A transformative learning paradigm based on experiential and critical constructivist conceptions of learning goes beyond instrumental and utilitarian learning conceptions that prevail in higher education institutions.

## Results

In the first survey, 790 undergraduate students responded to the question: *When you hear the word combination 'sustainable development', what of the following words comes to your mind?* 71% of the respondents indicated the concept of environment, 16% indicated society, 9% – economy and 4% – culture. This implies that the concept of sustainable development is largely defined in the context of the environment. Also, the great majority of students (89%) consider that sustainability should be taken into serious consideration in the university activities; however, only 27% have been taught something about environmental sustainability and sustainable development, and only 15% have done an assignment relevant to sustainable development in a course or seminar. However, when asked to indicate the most critical problem at the University of Crete, the respondents revealed that financial support of students' activities comes first (42%), followed up by the university image (32%), while environmental issues such recycling (30%), water waste (9%) and energy save (22%) revealed a lower consideration.

### *Students' anthropocentric-biocentric perceptions*

When it comes to students' anthropocentric vs biocentric attitudes, the results presented in Table 3 show a relatively strong commitment to the ethics of biocentrism, with an average biocentric attitudes mean score 3.7 in contrast to 2.6 of the anthropocentric attitudes. A statistically significant impact of participating in education for sustainability courses on the formation of anthropocentric attitudes has been revealed, $t(786) = -4.5$ at $p < .0001$. It implies that the higher the knowledge on sustainable development issues, the lower the anthropocentric attitudes. The paired samples t-test revealed a statistically significant difference between anthropocentric and biocentric attitudes with a mean difference -1.10, standard deviation 0.80 and $t(786) = -38.3$ at $p < .0001$. More specifically, there is relatively strong support (mean scores 3.5) for the anthropocentric notions that most environmental problems can be solved by advances in technology and that technology offers the means to restore environmental disasters, but less support is shown for the notion that most environmental problems can be solved through the production of wealth in a free market (mean 2.7) and even less support for the notion that "economic growth is more important than tackling environmental problems" (mean 2.3). There is also weaker support (mean scores 2.1) for anthropocentric ideas suggesting that human beings have the right to exploit Nature for their own profit and that other living organisms are subordinate to those of human beings, but there is more support (mean score 3.2)

to the anthropocentric notion that human welfare is the most important concern for human society. Similarly, there is relatively more support (mean score 3.2) to the anthropocentric notion that most environmental problems can be solved by changes in our life style, but not to sacrificing environmental quality if this benefits human society as a whole (mean score 2.2). It is true that anthropocentric views can be used to justify human's exploitation of natural and non-human world. However, it should also be noted that such exploitation does not account to all currents of anthropocentrism. A soft anthropocentrism, for instance, is reflected in the notion of 'shallow ecology' as contrasted to a strong biocentrism that is reflected to the notion of 'deep ecology' movement (Drengson, Devall, & Schroll, 2011).

Table 3. The anthropocentric and biocentric attitudinal results

| **Anthopocentrism vs biocentrism** | **strongly disagree** | **disagree** | **uncertain** | **agree** | **strongly agree** | **mean** |
|---|---|---|---|---|---|---|
| Most environmental problems can be solved by advances in technology. | 3 | 26 | 3 | 55 | 13 | 3.5 |
| Most environmental problems can be solved through the production of wealth in a free market. | 15 | 39 | 17 | 21 | 8 | 2.7 |
| What I can do in my country has little effect on foreign people's life quality. | 16 | 39 | 4 | 34 | 16 | 2.8 |
| Most environmental problems can be solved by changes in our lifestyle. | 10 | 28 | 4 | 46 | 12 | 3.2 |
| Human beings have the right to exploit Nature for their own profit. | 39 | 35 | 3 | 17 | 6 | 2.1 |
| On my own, I cannot do considerable things to protect the environment. | 25 | 38 | 1 | 24 | 12 | 2.6 |
| Humans have the right to adapt the natural environment to their own needs. | 30 | 33 | 4 | 33 | 10 | 2.8 |
| Human welfare is the most important concern for human society. | 7 | 31 | 7 | 41 | 14 | 3.2 |
| The rights of other living organisms are subordinate to those of human beings. | 37 | 41 | 5 | 12 | 5 | 2.1 |
| It is OK to sacrifice environmental quality if this benefits human society as a whole. | 40 | 33 | 4 | 15 | 8 | 2.2 |
| Human beings are the 'crown of all creation'. | 21 | 31 | 5 | 29 | 14 | 2.8 |
| Technology offers the means to restore environmental disasters. | 4 | 23 | 9 | 46 | 18 | 3.5 |
| Human beings are merely a 'cog in the machinery of Nature'. | 4 | 11 | 11 | 53 | 21 | 3.7 |
| Economic growth is more important than tackling environmental problems. | 31 | 41 | 5 | 16 | 7 | 2.3 |

### *Students' sustainability actions*

Of the 10 actions students were asked about, the one that scored the lowest was that of "doing any form of voluntary work" (mean 1.8), followed up by "giving money to poverty charities", "acting for the well-being of others" and "switching off unnecessary lights in class", all with the same mean score 2.3 (Table 4). Students scored higher on the action of "preferring to read texts on the computer screen" (mean 2.8) and "preferring to buy local products" (mean 2.7). In general, students' involvement in sustainability actions is considered relatively low (mean 2.5). It has also been revealed that in general left-oriented students are slightly more active towards the environment than more conservative students [$F(685) = 4.0$, $p < .05$]. Breaking the actions related to energy saving that is a hot issue at the University of Crete, according to students' academic discipline, the results presented in Table 5 show that students fall mostly in the least categories.

Table 4. Sustainable action statements and frequencies

| Action statements | Never (%) | Some-times (%) | Often (%) | Very often (%) | Mean (%) |
|---|---|---|---|---|---|
| Switch off unnecessary lights in class | 22 | 40 | 22 | 16 | 2.3 |
| Switch off unnecessary lights in WCs | 26 | 32 | 22 | 20 | 2.4 |
| Type on used papers | 21 | 37 | 25 | 17 | 2.4 |
| Prefer to read texts in the computer | 13 | 30 | 25 | 32 | 2.8 |
| Prefer to buy local products | 8 | 35 | 35 | 22 | 2.7 |
| Act for the well-being of others | 13 | 50 | 28 | 9 | 2.3 |
| Buy environmentally friendly products | 7 | 38 | 38 | 17 | 2.6 |
| Think of environment/health when you do shopping | 13 | 37 | 33 | 17 | 2.5 |
| Give money to poverty charities | 12 | 52 | 26 | 10 | 2.3 |
| Do any form of voluntary work | 40 | 44 | 12 | 4 | 1.8 |

Breaking the actions related to energy saving that is a hot issue at the University of Crete, according to students' academic discipline, the results presented in Table 5 show that students fall mostly in the least categories.

Table 5. Energy saving actions by students' discipline

| Students' environmental actions | Switch off unnecessary lights in class | | | | Switch off unnecessary lights in WCs | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Never (%) | Some-times (%) | Often (%) | Very often (%) | Never (%) | Some-times (%) | Often (%) | Very often (%) | N |
| Department of Primary Education | 22 | 36 | 20 | 22 | 23 | 31 | 19 | 27 | 203 |
| Sciences | 17 | 37 | 28 | 18 | 25 | 30 | 25 | 20 | 206 |
| Social Sciences | 22 | 47 | 21 | 10 | 26 | 33 | 26 | 15 | 249 |
| Department of Philosophy and Social Studies | 29 | 38 | 18 | 15 | 30 | 33 | 17 | 20 | 132 |

Table 6 shows that students of sciences have scored much higher on the action of "preferring to read texts in the computer screen" than students of any other discipline. A possible explanation for science students' higher rating to prefer reading in the computer screen could be attributed to their subject and not deriving from a biocentric orientation and value. Saving energy and reusing paper for printing are two key actions that highly contribute to environment protection.

Table 6. Sustainability actions to re-use and save paper by students' discipline

| Students' environmental action in: | Type on used papers | | | | Prefer to read texts in the computer screen than type | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Never (%) | Sometimes (%) | Often (%) | Very often (%) | Never (%) | Sometimes (%) | Often (%) | Very often (%) | N |
| Department of Primary Education | 28 | 35 | 25 | 12 | 11 | 33 | 23 | 33 | 203 |
| Sciences | 15 | 41 | 20 | 24 | 11 | 23 | 22 | 44 | 206 |
| Social Sciences | 22 | 35 | 29 | 14 | 17 | 32 | 25 | 26 | 249 |
| Department of Philosophy and Social Studies | 21 | 36 | 25 | 18 | 15 | 30 | 30 | 25 | 132 |

## *Students' preferences to university role and function*

Assessing the students' preferences towards Sterling's (2001) typology of higher institutions' roles and functions, the results presented in Table 7 show what values are dominant and what directions are needed to be taken. In total, there is a clear trend towards the transformative function that sees a university as an agent of change towards a fairer society and better world, regardless of the country the students come from. More specifically, 42% of students indicated a preference towards the transformative function, that is, a university which encourages change towards a fairer society and better world instead of replicating society and culture and promotes citizenship (6%). When taking into consideration the students' country, perceptions of preferences are spread between the liberal and the transformative function. Italian and Irish students indicated a clear preference to the liberal function, in contrast to the Greek students (56%) and Jordanian (46%) students who were oriented towards the transformative function. It is interesting to note that the Egyptian students' preferences are situated between the socialisation (28%) and the transformative (37%) function while a more balanced preference is revealed between the vocational, liberal and transformative function among Lebanese students.

Table 7. Students' preferences towards the role and function of universities

| **Perceived functions for universities** | **Total (%)** | **Greece (%)** | **Italy (%)** | **Ireland (%)** | **France (%)** | **Sweden (%)** | **Egypt (%)** | **Jordan (%)** | **Lebanon (%)** |
|---|---|---|---|---|---|---|---|---|---|
| To replicate society and culture and promote citizenship – **the socialisation function** | 6 | 1 | 1 | 0 | 1 | 1 | 28 | 8 | 1 |
| To train people for future employment – **the vocational function** | 21 | 17 | 24 | 15 | 14 | 9 | 17 | 22 | 30 |
| To help people develop their potential – **the liberal function** | 31 | 26 | 46 | 50 | 42 | 46 | 18 | 24 | 37 |
| To encourage change towards a fairer society and better world – **the transformative function** | 42 | 56 | 29 | 35 | 43 | 44 | 37 | 46 | 32 |

## Discussion and conclusion

The planet has currently reached an ecological point that necessitates a fundamental clarification and revision of human attitudes and behaviours towards sustainability. This crucial stage entails significant changes in the prevalent system of social, economic and cultural values that have led to the earth's degradation. Higher education plays a unique and critical role in making a healthy, just and sustainable society. Failing to take action may risk imposing significant costs on current and future generations and possibly widening the economic disparities among and within nations all over the world. The results presented show that there is need to address all the constituencies of a sustainable university.

In terms of teaching, learning and curriculum, students' relatively strong support for the anthropocentric notions that most environmental problems can be solved by advances in technology and that technology offers the means to restore environmental degradation, shows a need to redefine the concept of technological progress and contribute to bridging the gap between technological progress and societal values. Kemp and Soete (1992) discuss that some of the present trajectories of technological change have reached their environmental limits and there is need for them to be replaced by environmentally-friendlier trajectories. However, they point out that such transitions are not easy and are usually hindered by technical, economic and institutional barriers since the new trajectories have not benefited from 'dynamic scale and learning effects' and because the 'selection environment' is adapted to the old regime. This reinforces the need for adopting transformative teaching and learning methods. An interesting result of a revised curriculum is often a change in teaching style. From our experiences in the RUCAS project, faculty involved in revising their courses to address sustainability and implement the revised courses into their classes have moved from lecture approaches to more student-centred methods engaging students in the teaching and learning processes, such as clarifying own values, critical thinking, envisioning, service learning and discovery learning. The recent establishment of the network of social solidarity from students at the Department of Primary Education is an initiative that would highly contribute towards voluntarism.

Service-learning experiences include the processes of investigating community needs, preparing for service, action and reflection.

Our current economic model assumes and appears to blindly advocate that technology and free markets can be the main drivers of human progress and development, thereby also overcoming challenges such as alleviating poverty (Nair, 2012). Technology has not alleviated the daily struggle of millions of people and children who face hunger and malnutrition, who have been displaced by the floods due to climate change and profit-driven deforestation, who have no access to education, water and other basic human needs. An international and comparative study among student-teachers from Finland, Greece, Sweden, Japan and Holland (Makrakis, 2012b) shows that none of the sample country respondents identified themselves as optimists concerning the role and impact of science and technology on the society and the environment. The no-stance and the pessimistic attitudes towards technology and science seem to derive from the human and environmental costs associated with science and technology development. These results indicate that society and education, in particular, should place higher critical concerns about scientific and technological issues and their relation to the development of a sustainable society.

Students' disagreement with the notion that *economic growth is more important than tackling environmental problems* is indicative of the need to see alternatives to the gross national product (GNP) as the only measurement of a nation's progress. It has been for long recognised that the GNP is misleading as an indicator of the welfare of a nation, and many initiatives have been taken to develop more adequate measures of well-being, such as the genuine progress indicator (GPI) that considers consumer's point of view rather than the monetary value of GNP and adds the value of benefits such as volunteer work, which was found to be the least rated action among students at the University of Crete (Colman, 1998; Talberth, Cobb, & Slattery, 2007). Another reaction to replace the current global, profit-driven economic system, measured by GDP, with a new system, is the gross national happiness (GNH), coined by the Fourth King of Bhutan, Jigme Singye Wangchuck in the 1970s. The GNH concept implies that sustainable development should take a holistic approach towards notions of progress and give equal importance to non-economic aspects of well-being. GNH is based on a comprehensive list of conditions that lead to human happiness and well-being. They include measures of satisfaction with life and the health of citizens, community vitality, social support networks, access to education and to the arts, protection of the environment, and governance (Priesner, 2012; Ura, Alkire, Zangmo, & Wangdi, 2012). Lately the four pillars have been further classified into nine domains: psychological well-being, health, education, time use, cultural diversity and resilience, good governance, community vitality, ecological diversity and resilience and living standards.

Another aspect related to teaching, learning and curriculum that the results of the two surveys imply is the need to promote communication between academic disciplines. Universities need to become open institutions, thus avoiding fragmentation and over-specialisation, which had a negative impact to sustainability. No longer disciplinary knowledge and courses that function independently of real-life needs can cope with the sustainability challenges. The common thread seems to be an interdisciplinary approach and an understanding that sustainability is woven into all disciplines in undergraduate majors and the institutionalisation of minor degrees' concentration. Currently, there are no study programmes at the University of Crete providing an undergraduate unit

that integrates an interdisciplinary set of courses in subjects such as pedagogy, policy analysis, economics, the social and natural sciences to address the need to build a sustainable region and society. Also, the isolation in the higher education institutions from the labour market and stakeholder guidance in course design and content has placed sustainable development courses in a marginal position. A multi-stakeholder-driven model for modernising higher education curricula is needed, taking into consideration the urgent need for building university-community partnerships.

Introducing minors as supplements to undergraduate majors in the University of Crete and other Greek universities would be a critical step to the integration of interdisciplinary sustainability curricula and reversing the compartmentalised nature of higher education. Although interdisciplinary teaching and learning is being discussed at the University of Crete, in practice, there is lack of interdisciplinary perspective and motivation among teaching staff and students. Interdisciplinary collaboration is essential for modernising higher education, and it is a necessary condition for responding to the students' preference of a transformative role and function of a university.

In terms of research and development, tackling the sustainability challenges implies a redefinition of mainstream research and development policies that contributed to the degradation of the natural world. There is no concrete policy at the University of Crete towards this issue, although there are individual initiatives from teaching staff. For instance, the RUCAS – Tempus project that it is coordinated by the University of Crete is such an initiative which brings together 12 universities from the European Union and Middle East to reorient university curricula to address sustainability. This project has received a recognition award by the UNU for its contribution to reorienting learning approaches towards sustainability in institutions of higher education. Another project coordinated by the University of Crete was the ICT-enabled Education for Sustainable Development project also funded by the European Commission that resulted in the development of a M.Sc. programme on ICT in Education for Sustainable Development. It is worth pointing out the establishment of a research group working on PhD theses focusing on sustainability issues such as climate change at the Department of Primary Education within the UNESCO Chair ICT in Education for Sustainable Development.

Another major area of change would have to be institutional and administrative operations. Although educational institutions are often criticised for not opening their doors to the community, those involved in education for sustainability have taken initiatives to bridge the gap. The University of Crete has a policy for opening its doors to inter-institutional cooperation, but there is scepticism regarding opening its doors to the private sector for cooperation. There is, however, a need to redefine the University of Crete policy in order to bridge the gap between academic knowledge and societal demands. Signing of a declaration such as the Charter of Greek Sustainable Universities is seen as a strong indicator of commitment to sustainable development as well as an advocacy mechanism for translating the commitment into an action plan for a sustainable campus. This implies that declarations should be realised through concrete policies and actions, as well as to facilitate, encourage and reward individual teaching staff initiatives.

While the University of Crete is facing serious economic problems, energy is misused and students' sustainability actions are low. In an effort to reduce the large amount of energy currently generated from non-renewable resources such as oil, natural gas and coal, the University of Crete should take initiatives to provide awareness sessions, especially for new students, about energy saving and sustainability. The policies of the

University of Crete should also be taken into account considering actions on relying less on fossil fuels and turning to renewable energy resources, such as wind and solar power. Other sustainability actions should be directed to university dining service demanding the use of locally-grown and organic food. A composting system on campus should be also considered. In order to reduce food waste from ending up in the garbage, the dining service could collect waste food to send it to a local pig farm for feed and in cases of remaining food to send it to local food-charity banks. There is also a strong need to adopt a policy which ensures that copy paper used on campus contains at least 30% recycled materials and urge administrative offices, instructors and students to use online materials, and ask faculty members to make their courses paper-less by having students hand in their assignments online. Advocate through the university campus the slogan "Use less, recycle the rest". There are already departmental policies for donating computers from the various labs once they are no longer in use and give them to the community so that others can use them. There is also need to place bins for recycling across the campus. For institutionalising sustainability in the campus, developing Centres for Sustainability can be seen as instrumental in helping the University of Crete to turn into a sustainable university.

Finally, establishing partnerships and having an outreach orientation is very critical in turning the University of Crete into a sustainable university. Combining academic theory with practical real-life experience, service learning and other suitable to education for sustainability methods provide students with a broader and deeper understanding of the course content, foster their civic engagement into their place and community. Higher education that fails to develop learners beyond the acquisition of instrumental and utilitarian knowledge does not function in accordance to the values and principles assumed for a sustainable university. It becomes essential that universities should be involved in effective partnerships with non-formal and community-based institutions and other stakeholders, including local governments and small and medium sized enterprises to create sustainable development initiatives and bridge the gap between university and community.

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