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Education for sustainable development in higher education: evaluating coherence between theory and *praxis*

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Universities are an important part of the process of change taking place in society. However, this is often overshadowed by these institutions giving priority to technocratic models in the relationship between science and society. In this context, according to Habermas, theories can serve to clarify practical questions and guide *praxis* into the right actions (social emancipation and rational autonomy). Habermas introduces the need to evaluate the particular contexts in which scientific arguments are made and assessed. The aim of this study was to develop a set of assessment criteria for education for sustainable development in higher education curricula. These were developed in line with Habermas by introducing further adaptations within the context of education for sustainable development. These criteria were tested in a blended learning master's programme in Environmental Citizenship and Participation at the Universidade Aberta, Portugal. The following research tools were used as follows: (i) a questionnaire survey to the graduates; (ii) content analysis applied to the information guide and to the abstracts of the dissertations that were produced. The case study revealed that an absence of theoretical frameworks could lead to inconsistencies between theory and *praxis*. Improvements to curricula are then drawn from this study.

Keywords: higher education; education for sustainable development; theory of knowledge-constitutive interests

Introduction

The current economic crisis that western societies are going through is paralleled by a not less dangerous and profound crisis in education. The prominence that has been given to science and technology for the future and wealth of nations is also profit driven and cannot be ignored. As pointed out by Nussbaum (2010), there should not be any objection to good scientific and technical education, but other abilities and skills are equally important and should not be lost. Even if we are experiencing a period of deep changes, we should not be tempted to promote education for profit making to the detriment of education for a more inclusive type of citizenship

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(Bonnett 2013). Universities should be able to form individuals capable of withstanding the successive crises affecting contemporary society, envisaging crisis as ‘a moment that requires decisive action in order to be resolved’ (Edgar 2006, 29). However, in spite of being major agents of social changes, universities themselves remain very conventional, and the necessary change in mindset towards the creation of a sustainable future is a long-term effort.

The Johannesburg World Summit on Sustainable Development, in 2002, proposed the United Nations Decade of Education for Sustainable Development 2005–2014, where a clear statement was highlighted that education is at heart of sustainable development (UNESCO 2005). Nevertheless, the Millennium Ecosystem Assessment states that education for sustainable development is insufficient, and more informed and strategic measures are needed to address goals such as environmental protection (Millennium Ecosystem Assessment 2005). Also, the report of the United Nations Conference on Sustainable Development Rio+20 highlights the need to improve the capability of the education systems to prepare societies to pursue sustainable development (Leal Filho, Manolas, and Pace 2015). Those improvements include the enhancement of teacher training, the development of curricula towards sustainability and the development of training programmes that prepare students for careers in fields related to sustainability (UN 2012). Curricula are a key factor in university teaching. They reflect the university’s rules and course content and define programme outcomes. Curriculum reform offers an opportunity to make desired changes to degree programmes, offering a natural basis for examining existing practices and updating learning outcomes (Malkki and Paatero, forthcoming).

There has been an increasing interest in integrating sustainable development into curricula at all levels, as well as methods to achieve this, particularly in terms of students gaining an understanding of how their own decisions and actions of groups, corporations and states affect the environment and society (Lozano 2012). As a principle, sustainable development brings added value to the content and process of higher education. Higher education occupies a central position in shaping the way in which future generations learn to cope with the complexities of globalisation. Desha and Hargroves (2014) draw attention to the urgent need to increase curricula renewal in higher education. The process may be accelerated in the ‘coming decade, to align with requirements to respond to a growing range of environmental, social and economic challenges’ (Desha and Hargroves, 2014, 31). For this purpose, it is relevant to have adequate models of curriculum development based on the coherence between theory and *praxis*.

The emphasis of the research work developed by Barth and Rieckmann (2012) is that universities need to fully assume the existence of ideologies and theoretical principles underlying the curriculum proposals that they develop. There is often a hidden dimension that should be explicit. This would enhance gains in internal coherence and give greater visibility to the efforts of universities. Hence, the aim of this study was to develop a set of assessment criteria for education for sustainable development in higher education curricula that are able to evaluate the coherence between theory and *praxis*. These criteria were then tested in a blended learning master’s programme in Environmental Citizenship and Participation at the Universidade Aberta (UAb).

Education for sustainability in higher education curricula

International studies have evidenced a focus on education *about* sustainable development, rather than *on* education *for* sustainable development. Education for sustainable development is frequently a mere method for delivering and propagating experts' ideas about sustainable development, rather than an opportunity to work for participatory and metacognitive engagements with students over what is really meant by sustainable development (Jickling and Wals 2007). This generally leads to uncritical thoughts of the existing society and incapacity to provide real insight into the causes of real crisis (Kahn 2010). Too often there is a lack of solid philosophical background that allows a problematization of the dialectical relation between nature and culture, necessary to produce forms of consciousness that recognises the importance of a sustainable society.

By analysing higher education institutions, from a historical perspective, we understand that there were always premises simultaneously fostering the development of societies, even when these premises appear to be conservative (Amador and Oliveira 2013). At present, universities are already an important part of the process of change taking place in society, but this is often overshadowed by institutions giving priority to technocratic models in the relationship between science and society. In this context, it is relevant to consider the work of Habermas, who has an idea of 'social emancipation, which sharply contrast with the technocratic vision' of our time (Reghg 2009, 122). Habermas introduces the need to evaluate the particular contexts in which scientific arguments are made and assessed. But there is another dimension that is important to highlight – the relationship between disciplines and their critical evaluation (Reghg 2009).

In the last twenty years, several authors have dedicated their studies to evaluating sustainability in higher education institutions. Some assessment tools were developed exclusively for universities, trying to respond to the question *what to measure*, as well as to *how to measure*. Some examples of these tools are the Audit Instrument for Sustainability in Higher Education (Roorda 2001), the Environment Sustainability Assessment Questionnaire, and the EMS Self-Assessment (Shriberg 2002), the CSAF or Campus Sustainability Assessment Framework (Cole 2003; Sierra Youth Coalition 2012), the Graphical Assessment of Sustainability in Universities (Lozano 2006b), STARS or Sustainability Tracking Assessment & Rating System (Association for the Advancement of Sustainability in Higher Education (AASHE 2012), STAUNCH[®] or Sustainability Tool for Assessing Universities' Curricula Holistically (Lozano 2010), the Sustainability Report Card (Sustainable Endowments Institute 2011) and the DPSEEA-Sustainability index Model (Waheed, Khan, and Veitch 2011). The evaluation of the strengths and weaknesses of these specific tools, as well as others adapted and applicable to universities, has been the subject of several studies (e.g. Shriberg 2002; Cole 2003; Laroche 2009; Disterhelft et al. 2012).

In spite of all the research that has been carried out to explain and promote the integration of sustainable development into university curricula, it is recognised that more research work is needed (Lozano 2006a, 2010; Lozano and Young 2012). Recent studies highlight the need for a more comprehensive and holistic integration of sustainable development into curricula (Jorge et al., *forthcoming*). In addition, according to Lambrechts et al. (*forthcoming*), in a study conducted in Belgian universities, competences for sustainable development dealing with system orientation,

future orientation, personal commitment and action taking are virtually absent. It is thus important to strengthen sustainable development-related competencies in the curricula, such as: understanding complexity; identifying connections and interdependencies; participating in democratic decision-making processes; and critically questioning systems, policies and routines that appear fundamentally unsustainable (Leal Filho, Manolas, and Pace 2015).

Most of the previously listed tools, designed to assess sustainable development in higher education, are focused on campus operations/campus sustainability. Only the STAUNCH[®] tool permits higher education institutions to measure their contributions to teaching from a sustainable development perspective, using a set of criteria divided into economical, environmental and social aspects (Lozano 2010; Lozano and Peattie 2011; Lozano and Young 2012). As a result of an analysis carried out by Glover, Peters, and Haslett (2010) on the validity of this curriculum auditing tool, the need for more research in this domain has been identified.

Development of a set of criteria for education for sustainable development and higher education curricula

Universities can take an active role as centres for both inquiry and action in local, regional and global space(s). Barth and Rieckmann (2012) summarise several existing frameworks and distinguish different patterns of education for sustainable development. Those patterns vary from process of character of implementation in introductory lecture series to transformative curriculum change, including ‘build-in’ approaches (education for sustainability) and curriculum redesign (sustainable education). According to those authors, sustainable development is not just another topic to be considered in the curriculum, but it challenges conventional discipline-oriented and teacher-centred approaches, and asks for participatory and competence-oriented approaches in higher education. Huckle (1993) adds that environmental education programmes that are constructed within the empirical–analytical sciences can address technical interests, while other programmes that are based upon the interpretative sciences can address practical interests. In sustainability education, this is essential because it uses critical sciences as means to develop an adequate response.

Universities must often confront positivist rationality, founded on the belief in objectivity and the neutrality of scientific knowledge. This translates to assigning an instrumental value to acquired knowledge. At the same time, there is an unquestionable belief that the change of ethical values and attitudes towards sustainability problems, including environmental ones, is a natural consequence of learning. This needs to be corrected through a critical approach of theory and practice in terms of education (Carr and Kemmis 2004). For this purpose, resources should be provided that enable students to distinguish the ideologies that lie behind many statements and acquire skills that permit them to understand that there is a level of principles underpinning the construction of disciplinary knowledge. This should correspond somewhat to the ‘hard core’ in the Lakatosian model (Lakatos 2001). The mathematician and philosopher claimed that all sciences possess a set of dominant principles that are beyond questioning. This is usually untouchable and is protected from falsifiability processes by a ‘protective belt’.

Epistemological reflections are important in the construction of any classification/assessment grid, like the one proposed in this study. But it is also important to

develop a more comprehensive approach. In a Habermasian perspective, theories can serve to clarify practical questions and guide *praxis* in action, covering for example stages of emancipation. Habermas centres his analysis on the relation between theory and *praxis* in the following: (i) the empirical aspect of the relationship between science, politics and public opinion in current societies; (ii) the epistemological aspect of the relationship between knowledge and interest; (iii) the methodological aspect of a social theory which aims at being capable of assuming the role of a critique (Habermas 1973).

In the theory of knowledge-constitutive interests, Habermas states that there is a precondition that makes knowledge possible – the interest of our biological species in generating knowledge about the physical and social world, and the exercising of political power (Habermas 2004; Edgar 2006). In turn, this knowledge will be linked to different action forms (Table 1), meaning the intentional and meaningful action of individuals, groups or organisations.

Taking the Habermasian idea for the need of a theory that leads to action, and that ‘education for sustainable development’ objectives need to be clearly articulated if higher education is to be able to assess, or evaluate, their achievement (Shephard et al., *forthcoming*), a set of four categories was established, as follows (Table 2): (i) principles (theoretical level); (ii) pre-action (level 0); (iii) pre-action (level 1); (iv) praxis (action level). The first category is linked to each of the three interests shown in Table 1, each one leading to different actions (praxis). ‘Pre-action level 0’ is taken as an intermediate category or as a final category associated with the acquisition of knowledge, assuming often the form of causal scientific explanations. The following category – ‘pre-action level 1’ accounts for ‘understanding and clarifying the condition for meaningful communication and dialogue’ (Carr and Kemmis 2004, 135) in social contexts. Production of interpretative ‘arguments could inform and guide practical judgment’ (Carr and Kemmis 2004).

Table 2 includes the definition and meaning of each of the four categories, in the context of education for sustainable development in higher education. These then lead to the criteria of assessment for education for sustainability in higher education curricula, in terms of course syllabuses and students competences.

Although a sequential and linear model can be envisaged as a series of steps from a theoretical level to a practical level (Figure 1), this will not correspond to what it is found in most situations. It is necessary to predict moments of feedback, not only to seek consistency between *praxis* and theory, but also to allow for reformulations and thus have an epistemological value.

Table 1. Synthesis of Habermas’ theory of knowledge-constitutive interests.

Interest	Knowledge	Action
Technical	Instrumental (causal explanation)	Facilitate technical control over nature
Practical	Practical (understanding)	Improved communication and understanding
Emancipatory	Emancipatory (reflection)	Political emancipation of the oppressed; freedom and rational autonomy

Source: Adapted from Edgar (2006) and Carr and Kemmis (2004).

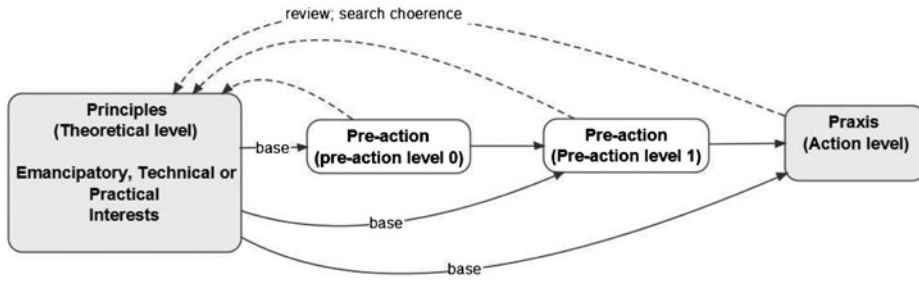


Figure 1. Interaction model between categories.

A case study of a blended learning Master's in Environmental Citizenship and Participation at UAb

In order to assess what has been achieved in terms of education for sustainable development, an analysis was carried out on the postgraduate programme in Environmental Citizenship and Participation, taking into account the set of criteria summarised in Table 1 and defined in Table 2.

The Master's degree in Environmental Citizenship and Participation has been on offer at UAb, the distance learning university in Portugal, since 2006. It is a formal course, organised according to the European Credit Transfer and Accumulation System (ECTS), and taught in blended learning methodology, defined as e-learning complemented with instructor-led training and other live formats (Bersin 2004). Curricular units, as shown in Table 3, are delivered online, except for one curricular unit which includes a mandatory one day face-to-face workshop, also live transmitted for those not able to physically attend. The maximum number of students per virtual class is 30. The programme has the duration of three semesters: the first two semesters consisting of the curricular year (60 ECTS) (Table 3) and the third semester being dedicated to the planning, developing, writing and defending of the master's dissertation/ thesis (40 ECTS). The semester is defined as a period of 20 weeks. The open source Moodle (<http://elearning.uab.pt/>) software is used as the learning management system. The programme articulates vertically with a first cycle degree in Environmental Sciences and a third cycle degree in Social Sustainability and Development, both delivered mainly online, following the UAb pedagogical model. All programmes at UAb are directed to an adult working population.

The Master's degree in Environmental Citizenship and Participation aims at a target audience of governmental workers, policy makers, public and private environmental advisors, members of environmental non-governmental organisations, teachers, researchers and individuals involved in environmental practices, policies, planning, training, participation and citizenship. Subjects, methodologies and the case studies developed/used in this programme are drawn from the environmental sciences and social sciences. The pedagogical model underlying the learning process was developed specifically for distance learning at the UAb and adopts a continuous assessment regime (Pereira et al. 2007). A student information guide and course syllabuses are always accessible online at the university site (<http://www.uab.pt/>).

The master's degree has been evaluated, yearly, at two distinct moments (end of first semester and end of second semester) using confidential questionnaire surveys (Bacelar-Nicolau et al. 2009, 2012). The first survey intended to assess the

motivation and satisfaction level of students and also related to the blended learning regime (Gilbert, Morton, and Rowley 2007). The second survey aimed to evaluate student's knowledge acquisition on key concepts of environmental/social sciences, their sensing of personal attitudinal and behavioural changes in specific environmental/social areas and their course achievements in relation to their expectations (e.g. acquisition of professional competences, public participation). The surveys indicated that students felt a high level of motivation and satisfaction (Bacelar-Nicolau et al. 2009, 2012).

Methods

In line with the characteristics of a case study, and in order to test the grid based on the theoretical analysis outlined (Table 2), a quantitative approach was adopted. Different research techniques were applied: a questionnaire survey to all graduates who had completed the master's programme, and content analysis of the course syllabus and the abstracts of the dissertations produced.

The questionnaire survey consisted of 16 statements designed to assess ex-students perception of the application of education for sustainable development throughout the master's programme. The questionnaire was sent to all the students who completed the master's between 2007 and February 2015, a total of 50 students. Statements are based on the categories presented in Tables 2 and 4. To each one of the categories, four statements were associated, two centred in individual aspects and two focused on the curriculum. The statements were then presented in random order and associated to a Likert scale of 5 points from 'totally in accordance' to 'total disagreement'. Appropriate criteria of clarity and objectivity were used and a pretest was conducted to validate efficacy (Foddy 1993; Cohen, Manion, and Morrison 2007).

The content analysis was conducted on the dissertation abstracts of the 50 students who had completed the master's programme and also on the course syllabuses available in the student information guide. The purpose of the content analysis was

Table 2. Categories/criteria of analyses in the context of education of sustainable development in higher education curricula.

Categories/levels	Definition
Principles (theoretical level)	Philosophies, ideologies and principles underlying statements and decisions, expressed explicitly or easily inferred
Pre-action (pre-action level 0)	Undertake analysis and develop skills in a progressive process Intermediate category associated with the acquisition of knowledge, assuming often the form of causal scientific explanations
Pre-action (pre-action level 1)	Prepare for action, outlining interventions, analysing consequences. Shows a concern in understanding and clarifying communication and dialogue in social contexts, based on the view that a solid theoretical argumentation could inform and guide practical judgment
<i>Praxis</i> (action level)	Development of student attitudes that permits them to fight for what they consider right, good and just

Table 3. Curricular plan of the master's degree in Environmental Citizenship and Participation offered at the Universidade Aberta (UAb, Portugal).

1st Semester – Fundamentals (optional curricular units, from which students select 30 ECTS)	
Optional curricular units	ECTS
Land use management	6
Pollution and resources	6
Waste management	6
Environmental management tools	6
Biodiversity, geodiversity and conservation	6
Food consumption and environment	6
Elements for the social analysis	6
Environmental impact assessment	6
Promotion health and environment	6
Sustainable management of marine resources	6
2nd Semester – Practical methodologies and techniques (30 ECTS)	
Compulsory curricular units	ECTS
Ethics and Environmental Citizenship	6
Policies for sustainability	6
Participation and interactive methods in environmental decision-making ^a	6
Methodologies of social intervention	6
Projects and methodology in Environmental Citizenship	6

^aCurricular units taught in blended learning with a one day face-to-face workshop.

to identify to what extent the four phases/categories, as presented in Table 2, are present in the different documents.

The content analysis was conducted independently by four *judges* (teachers of the master's degree) using the defined categories. Each category was scaled from 0 to 3: 0 stands for a total absence of reference within the appraised category; 3 stands for 3 or more references within the appraised category. The procedure proposed by Hernández Sampieri, Fernández Collado, and Baptista Lucio (2006) has been followed in order to determine the level of agreement between the judges.

$$\text{Agreement} = C_{1,2} + C_{1,3} + C_{1,4} + C_{2,3} + C_{2,4} + C_{3,4}/6$$

For data analysis, the mode and relative frequencies were calculated for each category.

Results and discussion

A response rate of 56% (28 students) was obtained for the questionnaire survey. The results are shown in Figure 2, where a bigger discrepancy between the results of the category 'principles' can be seen. This means that, as far as the theoretical principles are concerned, the students have a different perception about what they have learned and about what is taught in the programme. This could be a result of the low critical skills present in this student population, or could be an effective problem in the identification of a theoretical framework. The pre-action category level 1 shows the greater consistency between the students' judgment and the evaluation of the programme. The discrepancies of evaluation are greater in extreme categories, which is in line with the issues that were discussed in the literature (Carr and Kemmis 2004; Habermas 2004; Edgar 2006).

Table 4. Statements applied in the questionnaire related with the categories/criteria of analyses in the context of education for sustainable development in higher education curricula.

Categories (levels)	Statements included in the questionnaire survey	
	Relating to individual aspects	Relating to the curriculum
Principles (theoretical level)	<ul style="list-style-type: none"> The fundamentals and principals acquired in the programme lead to a more informed intervention in society The theoretical training acquired provides the arguments to support my views and options in the area of education for sustainable development 	<ul style="list-style-type: none"> All the courses on the programme are supported in paradigms of education for sustainable development Overall, the theoretical principles and philosophies of the programme, as a whole, are clearly identified
Pre-action (pre-action level 0)	<ul style="list-style-type: none"> The knowledge acquired in the programme was very helpful to explain facts and events The main skills that I developed are related to the capability to address a particular issue in a systematic way 	<ul style="list-style-type: none"> The contents of the various courses highlighted the explanation of the processes Throughout the programme, knowledge acquisition was particularly valued, also as a way to enable a more enlightened action
Pre-action (pre-action level 1)	<ul style="list-style-type: none"> I have been more attentive to public participation processes in environmental issues, after finishing the programme I'm able to design or collaborate in preparing interventions in citizenship and participation for sustainable development 	<ul style="list-style-type: none"> The theoretical background provided in the programme aims to prepare for intervention in contexts of a social dialogue within the framework of education for sustainable development The programme enabled me to arrive at critical judgments about interventions performed in education for sustainable development
Praxis (action level)	<ul style="list-style-type: none"> I believe there is a 'before' and an 'after' the programme, in what concerns my involvement in actions in the field of education for sustainable development My biggest involvement in participation processes of Environmental Citizenship resulted from a change of attitude induced by the programme 	<ul style="list-style-type: none"> The course encouraged student's participation in direct action in the context of Environmental Citizenship and Participation Throughout the programme, there was a concern to stress that further than the knowledge it is important that one is able to take educated action

The relation of the results shown in Figure 2 with the data obtained from the content analysis will determine the existing level of consistency between theory and praxis, based on the adopted theoretical framework. Table 5 reports the data, and the

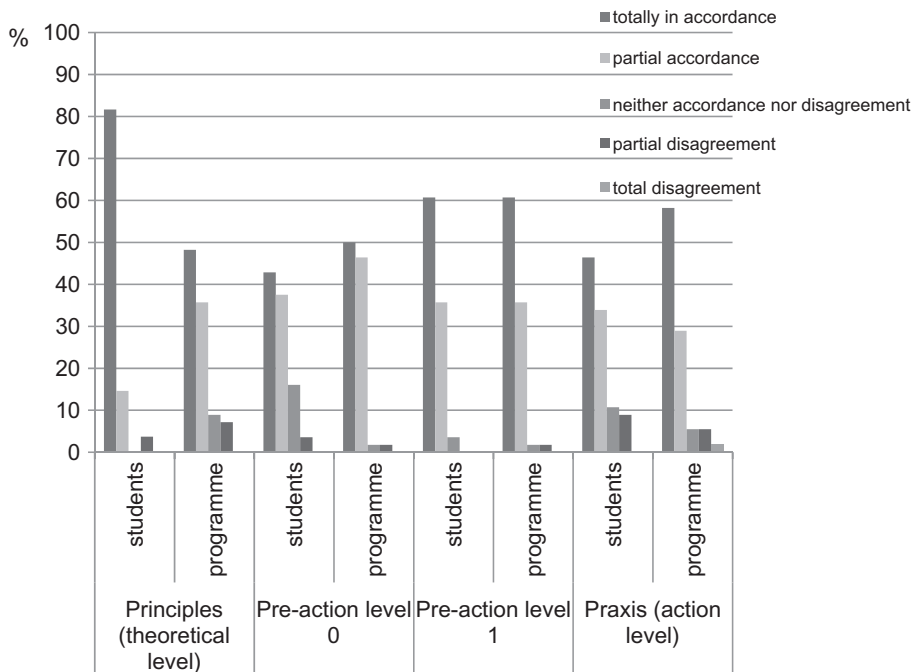


Figure 2. Questionnaire answers (mean values) to the different statements grouped in the four main categories.

Table 5. Content analysis of thesis abstracts.

	Index of agreement inter-judges	Mode	Relative frequencies (%)			
			0	1	2	3
Principles (theoretical level)	0.57	0	46.2	32.2	19.1	2.5
Pre-action (pre-action level 0)	0.47	2	9.0	30.7	48.7	11.6
Pre-action (pre-action level 1)	0.64	0	57.4	20.8	13.2	8.6
<i>Praxis</i> (action level)	0.81	0	83.2	11.5	2.1	3.1

index of agreement indicates the level of discrepancy on how the judges evaluate the integration of the various components in the curricula.

According to Krippendorff (2004), variability between judges' classification is usually expected. Nevertheless, the higher level of disagreement in the pre-action and action levels reflects the different coders/teacher's perceptions associated with the theoretical background of action levels.

In spite of this variability a pattern of distribution is found, with a greater occurrence for both the theoretical and pre-action level (in the theoretical level, 53.8% and in the pre-action 91% scored as 1, 2 or 3 – Table 5). These results are in line with the results of the questionnaire, as shown in Figure 2. In the dissertation abstracts the most common issues are acquiring knowledge and planning for action. In general terms, the process of curricular development in higher education is essentially focused on the students' competencies improvement and acquisition, as well

as their final outcomes, and not so much on the critical approach to theory and praxis, as highlighted by Carr and Kemmis (2004). These are important issues that should be addressed within education for sustainable development, which means that higher education institutions will need to provide the proper foundations of the concept within their multiple interconnected and trans-disciplinary dimensions (Lozano and Young 2012).

A further content analysis was performed on the syllabus of the curricular units as provided in the student information guide. The results are shown in Figure 3, and the existence of a balance between the three dimensions – principles, pre-action level 0 and praxis – should be noted.

Nevertheless, at the principles level, central theoretical questions such as political, ethic and ideological debates are only present in a few courses; namely in ‘Policies for Sustainability’ and ‘Ethics and Environmental Citizenship’. Lecturers usually avoid more controversial and less straightforward debates, where political and ideological issues are addressed, and questions such as ‘which society pattern should we move to?’ should be discussed. Educators ought to be knowledgeable and skilful in their disciplines, but also they should pursue the systemic and complex frame of reference of sustainability (Svanström, Lozano-García, and Rowe 2008). In addition, for transformative changes and built-in towards education for sustainable development, academic staff must have capabilities and willingness to support such processes (Barth and Rieckmann 2012).

The action category is only present in ‘Projects and Methodology in Environmental Citizenship’, a second semester curricular unit which aims to prepare the project of the master’s dissertation. It is less expected that during other curricular units

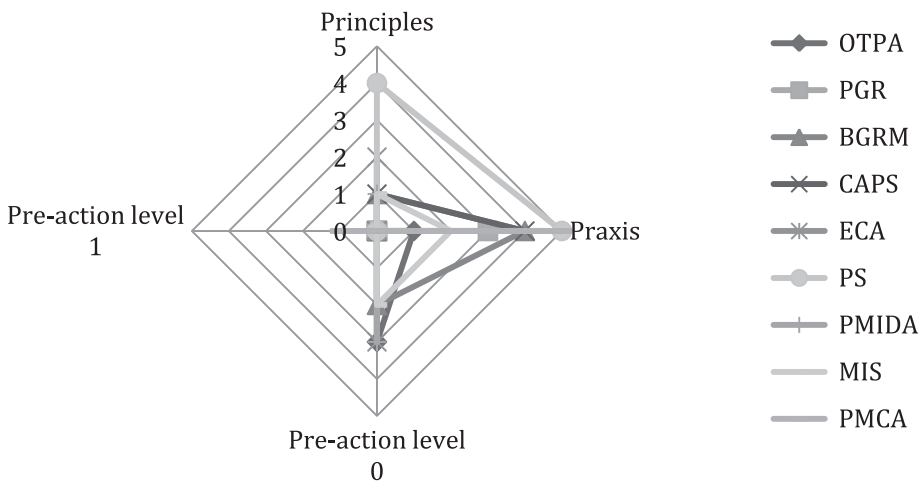


Figure 3. Content analyses conducted on the Student Information Guide and Course Syllabuses.

Notes: The different courses are represented by their respective acronym: OTPA: Land Use Management; PGR: Pollution and Resources; BGRM: Biodiversity, Geodiversity and Conservation; CAPS: Food Consumption and Environment; ECA: Ethics and Environmental Citizenship; PS: Policies for Sustainability; PMIDA: Participation and Interactive Methods in Environmental Decision-Making; MIS: Methods for Social Intervention; PMCA: Projects and Methodology in Environmental Citizenship.

students develop attitudes that enable them to fight for what they consider right, good and just, and be evaluated for that.

According to Onuki and Mino (2009) and Lozano and Young 2012, master's theses in education for sustainable development should encourage students to address complex sustainability problems through a trans-disciplinary approach. The Master's degree in Citizenship and Environmental Participation, at UAb, is fairly recent and conceived to promote interdisciplinary within the subjects and among the teachers of different scientific backgrounds. However, the reality shows that the desirable diversity also brings in different conceptual frameworks which need to be well matched. This was also one of the findings of the case study, and it points towards the need for more encouragement and engagement in the student's and teacher's actions, as well as to the development of long-term student's attitudes and behaviours.

Conclusions

This article proposes to explore and interpret the relationship between theory and praxis concerning education for sustainable development in higher education curricula. A set of assessment criteria was developed and used for the analysis of a master's course on Environmental Citizenship and Participation offered at UAb, Portugal. Two main findings should be stressed: (i) that there is a considerable discrepancy between what the students perceived as the fundamental principles learned concerning education for sustainable development and its clear identification within the curricula of the master's course; (ii) the different perceptions of the teachers as far as the acquisition of knowledge and planning an action (as defined in Table 2) is concerned. In the case of the questionnaire survey, this discrepancy may also reflect the different scientific backgrounds of the students and can be seen as a confirmation that, although an increasing number of higher education institutions have been engaged in integrating sustainable development into their curricula, this has not yet infused into all disciplines.

The content analysis performed on the students' abstracts and the syllabus highlighted some drawbacks on the programme, namely in what concerns a paradigm shift towards a systemic perspective emphasising collaboration and cooperation. Education for sustainable development deals with complex interactions between human activities and the environment, technologies and policies, issues that cross over disciplinary boundaries. Higher education is generally organised into highly specialised areas of knowledge and disciplines, resulting in professionals who are ill-prepared for cooperative efforts and often discouraged from extending their work into other disciplines. As Barth and Rieckmann (2012) highlighted, the potential benefits of academic staff development in this knowledge area are their relevance for initiating individual learning processes as well as for facilitating social learning. In this context, a deep-rooted education for sustainable development requires an approach which links staff development and organisational change.

This confirms the idea that the development of academic staff abilities is an essential prerequisite for a sustainability paradigm shift in higher education. Other examples can be found in (i) the project University Educators for Sustainable Development (www.ue4sd.eu), (ii) the research of Lambrechts et al. (forthcoming) focused on what competencies for sustainable development should be addressed, in particular to promote action taking or (iii) the approaches to categorise

affective learning outcomes for behaviour changes discussed by Shephard et al. (forthcoming).

This study shows the importance of having a theoretical framework supporting a set of criteria through which curricular assessment takes place, and provides a clear picture of the manner in which sustainability issues are addressed in different courses. Curricula assessment should also be complemented with research on pedagogical approaches and their effectiveness in delivering sustainability education, and ‘educating the educators’, as stressed by Lozano and Young (2012). For these approaches, service learning and interdisciplinary collaboration, and working with a real client or community are encouraged (Walker and Seymour 2008).

Further research should be carried out to improve the definition of the criteria and their applicability – in particular applied to other study cycles and using other research methods: e.g. interviews or focus groups with students and ex-students, and including teachers – to better access the quality and effectiveness of education for sustainable development in higher education curricula, including the action level of the proposed criteria.

Disclosure statement

No potential conflict of interest was reported by the authors.

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