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Design and evaluation of learning processes in an international sustainability oriented study programme. In search of a new educational quality and assessment method

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ABSTRACT

Debates relevant to transdiciplinary and sustainability oriented teaching at the higher education level anticipate necessary transitions in curricula. This article describes an international sustainability-oriented teaching and learning programme at the higher education level, where theoretical concepts developed over recent decades were applied in teaching practice, tested and reflected upon. The authors have operationalized conditions for learning success in a transdisciplinary learning environment, designed courses so that desirable competences were not only a by-product of sustainability oriented teaching, but its primary educational goal, developed (formative) assessment tools, observed the specifics of the environment in which particular courses have been realized (e-learning setting), and received feedback on students' perceptions of various aspects of their learning. While the content of the programme was concerned with the principles of sustainability, its methodological focus on competences was associated with a change in communication practices between teachers and students that have been gradually liberated from the traditional transmission model in favour of a more open and interactive one. Analysis of the students' perception of the learning process showed their attitudes and approaches to learning ranged from a surface approach to a deep approach; desirable approaches have been identified as core educational qualities to be preserved within curricular innovations. The article contributes to understanding the role of the learning environment which provides the opportunities for teacher interventions to support interactive and self-directed learning.

1. Introduction

With regard to their potential engagement in society, and active participation in its transition toward sustainability, universities have to develop a 'third role' (Zilahy, Huisingh, 2009) within which they contribute to the social capital of society (Lehmann et al., 2009). This requires a change of communication patterns in science and education (Franz-Balsen and Heinrichs, 2007; Adomssent, 2013), with growing interactions at the disciplinary level (Waas et al., 2010), or with other societal actors (Steiner and Posch, 2006; Ferrer-Balas et al., 2010); thus 'new interfaces between science, technology, society, environment and ethics' are created (Correia et al., 2010), and new opportunities for diverse actors to meet and enter a dialogue (Ferrer-Balas et al., 2008) opened up. In education, this development results in discussions about new educational goals – competences, such as creativity, reflexivity, and social learning skills – together with more complex changes at the curricular level (Lozano, 2006). Related changes within the learning environment, which is supposed to be a more integrative system with new communication opportunities, is part of this process (Burandt and Barth, 2010). In reality, these relatively profound changes are integrated into the education system with difficulty (Mulder et al., 2012) and are often rejected by those who should implement them due to their perceived non-systemic character. As Lozano (2006) points out, the concept of sustainable development contrasts with existing habitual practice in universities, and thus many sustainability

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innovations are considered to be quite 'radical'; most of them are still at an early stage of implementation (cf. Lozano et al., 2013). To achieve transformation, a search for new links between educational theories and practice might help.

Changes in sustainability oriented education are, in general, closely associated with changes in science (cf. Hessels and Van Lente, 2008), in particular with the emerging concept of sustainability science (Ravetz, 2006; Bolin et al., 2000) – as Barth and Michelsen (2013) point out, educational science contributes to sustainability science and vice versa. There is rapid development in this field: for example, the recently discussed *future perspective* has been identified as one of the core stimuli required for change and to have an impact on sustainability research and problem-solving methods (cf. Wiek and Iwaniec, 2013). On the other hand, established theories might be exploited in education, such as the Bloom taxonomy for its sustainability oriented transition, with great benefits for practical activities in this field (Lozano et al., 2015). This article endeavours to continue with these efforts, and outlines a few theoretical concepts to help achieve a deeper understanding of real-life processes in higher education. Section two offers an insight into the transdisciplinary learning process and its characteristics; this is accompanied by a reconsideration of teaching methods, tools for assessment, and especially the learning environment, to achieve the desired educational quality within sustainability oriented innovation. In Section three, these concepts are observed within the interdisciplinary study programme, where desirable educational goals are formulated and learning modules designed, so that progress in learning, and its results, could be reflected upon (as they are archived in an e-learning environment in this case). These main specifics and achievements of the study programme are described from a *learning process* point of view, and consequently (Section four) the pre-requisites for a desirable quality teaching/learning process are discussed. As the role of the learning environment has been highlighted throughout these steps, the authors describe its part in supporting teacher/learner, and learner/learner interaction, with a resulting incremental change in their roles (Entwistle et al., 2002, 2003).

2. Theoretical concepts and practical challenges

Education for Sustainable Development (ESD) is considered to have a significant influence on environmental awareness, everyday lifestyles and consumer behaviour (Zsóka et al., 2013). ESD is, however, a complex and sometimes contradictory field (being both practically relevant at a local level and holistic) which therefore 'requires careful communication with multiple stakeholders, and at multiple levels' (Wals, 2009). Implementation of the *holistic principle*, which is also stressed in international documents (UNECE, 2011; Tilbury, 2012), has been recognized as necessary for solving complex issues systemically (Charnley et al., 2011); in practice this requires different disciplines and social actors to meet, learn from each other, communicate and search in unison for creative solutions. Also, the university system should respond to these challenges, and change from being highly specialized to multidisciplinary, interdisciplinary, and in the last stage trans-disciplinary to ensure that students gain knowledge, not only within their particular disciplines, but become aware of the consequences of human actions in other fields, and are able to view them from both a short- and long-term perspective (cf. Roorda, 2002). The transdisciplinary requirement increases the need for social interactions in HE teaching, with a consequent need for redefinition of educational goals and expected outcomes of learning, including assessment. In this field, an important learning outcome is considered to be not only theoretical knowledge and its application in practice, but also an understanding of the context of a particular (learning) situation, and development of other competences, such as critical thinking (cf. Dlouhá et al., 2013a). To transform teaching practices toward transdisciplinarity, the design of the learning environment, and its tools for interactive involvement, have to be reconsidered as well.

2.1. ESD related transition in the cognitive field

In the 'knowledge transmission' model, where the student is perceived as a passive(?) recipient of existing knowledge created outside the learning environment, teacher–student interactions, as well as the (learning) context, does not play a role. The fundamental shift in this perspective occurred in the late 1970s and 1980s when attention shifted to the *learning process* as a distinct field, with its own problems and methodologies. The attention paid to learning processes was associated with theories that have a constructivist background (students are actively engaged in their learning), and are based on situational understanding (student behaviour is affected by the learning context, cf. Gijbels et al., 2006). The first studies from Britain and Sweden were focused on educational content, and especially the context of courses, and the latter's impact on learning achievements. The conclusion was that different factors result in different student approaches to learning: a surface, deep and achieving learning approach (Biggs, 1987). A desirable *deep study approach* as opposed to *surface* (cf. Entwistle et al., 2002) can be described as 'looking for meaning in the matter being studied, and relating it to other experiences and ideas with a critical approach'. Students adopting an in-depth approach aim to understand the subject, are intrinsically interested in, and derive enjoyment from, studying. A surface approach can be thought of as a 'reliance on rote-learning and memorization in isolation from other ideas. Surface learners perceive the task of learning as an external imposition and they are externally motivated. They typically treat parts of the subject as separate entities and fail to integrate topics into a coherent whole' (Duff, 2004). Deep learning has been identified as specifically relevant for interdisciplinary and holistic thinking in the sustainability context (Warburton, 2003).

Research has shown that student *approaches to learning* considerably affect the learning process in terms of its efficiency, and have an impact on final student performance. Learning was thus perceived as a complex process where students' individual preferences, perceptions of the learning environment and motivations, rather than their intelligence, are important. These external factors, subsumed under the social aspects of the learning environment, also include the demands imposed on students, the quality of the teaching and the nature of the assessment, student support and the enthusiasm shown by the instructor, as well as the opportunity for students to manage their own learning process (Richardson, 2009). This perspective changed the perceived (convential?) role of the teacher, and it brought about the possibility of influencing the learning process and the resulting student achievements through teacher interventions and changes of learning environment to a much greater extent (ibid.). Paying attention to the learning process is relevant in *dynamic learning* situations (where multiple learners interact and collaborate), results in the achievement of higher cognitive skills (Segalas et al., 2010).

2.2. Competences as outcomes

The concept of *competences* is based on a combination of skills, knowledge and attitudes that are appropriate to particular situations (cf. Dlouhá, 2009); they combine anticipated results in the