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Assessing Sustainability in higher education curricula: a critical reflection on validity issues

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Abstract

While curricular assessments can give insight as to the extent sustainability is integrated into higher education study programs, issues remain regarding how assessments are conducted. Previous research has identified and compared various sustainability assessment tools for higher education, but there is a gap in literature studying issues arising from measurement. This paper highlights the need for discussions on this topic by exploring validity issues arising from a case study and discusses the potential of utilizing a supplementary course file during curricular assessments. To achieve this objective, a KU Leuven Faculty of Economics and Business program has been assessed using two different approaches, namely 1) a scan of a European Credit Transfer and Accumulation System (ECTS) file and 2) an instructor self-assessment via a supplementary course file. Based on this research, these two approaches to curricular assessment yield substantially different results, which gives rise to the need to further consider the validity of such assessments. While utilizing an instructor self-assessment (e.g., a supplementary course file) during assessments can help overcome some potential shortcomings and biases of ECTS file scans, both approaches are flawed in assessing true sustainability integration into a program. The varying conceptualizations of sustainability and the lack of uniformly adopted assessment approaches has the potential to create validity issues with the assessment of sustainability in higher education. Acknowledging sustainable development as a contested concept, and developing a faculty-specific conceptualization, can help in approaching assessments in a meaningful way.

Keywords: Sustainability assessment, curricular assessment, higher education, business school, STARS

List of abbreviations: AACSB: Association to Advance Collegiate Schools of Business; AASHE: Association for the Advancement of Sustainability in Higher Education (AASHE); CSR: corporate social responsibility; ECTS: European Credit Transfer and Accumulation System; EfS: education for sustainability; ESD: education for sustainable development; EFMD: European Foundation for Management Development; FEB: Faculty of Economics and Business; HEI: higher education institution; MIBEM: Master of International Business Economics and Management; PRME: Principles for Responsible Management Education; SD: sustainable development; STARS: Sustainability Tracking, Assessment & Rating System

1. Introduction

The integration of sustainable development (SD) has become a relevant topic in higher education and increasingly, higher education institutions (HEIs) are attempting to take responsibility as agents in promoting SD principles (Lozano et al., 2015; Lukman and Glavič, 2006; Ramos et al., 2015). HEIs can contribute significantly to fostering the transition towards a sustainable society due to their double role: 1) creating knowledge and transferring this knowledge to the society, and 2) preparing students for their future role in society (de Lange, 2013; Disterheft et al., 2013). Business schools

have particular responsibilities to prepare their graduates to make ethical and responsible economic and management decisions (Figuro and Raufflet, 2015; Stubbs and Cocklin, 2007; Wu et al., 2010), as well as specific challenges to integrating sustainability into their curricula, including gaining faculty awareness of SD and faculty support for such integration (Maloni et al., 2012; Rusinko, 2010).

HEIs are faced with increasing requests to disclose how they integrate, and contribute to, sustainability, for example, from quality management systems (Holm et. al., 2015; Wals, 2014), or by participating in voluntary initiatives such as Principles for Responsible Management Education (PRME, 2016). In recent years, there has been an emergence of different sustainability assessment tools for higher education (see Shriberg, 2002; Yarime and Tanaka, 2012). Subsequently, the topic of sustainability assessment has been receiving more attention in literature (Ceulemans et al., 2015). For example, a special issue of *Assessment & Evaluation in Higher Education* has recently been devoted entirely to this topic (Shiel et al., 2015). Sustainability assessments examine the integration of sustainability into HEIs' functions of education, research, operations, and community engagement (Fischer et al., 2015; Lozano, 2006; Yarime and Tanaka, 2012). Within the realm of education, curricular assessments examine the presence of sustainability themes in the curriculum. Curricular assessments give insight as to the extent sustainability is integrated into study programs, which can offer university leaders a starting point for change (Lozano and Young, 2013). However, consensus has not been reached on how exactly to assess the integration of sustainability in curricula (Shriberg, 2002), as evidenced by the varying assessment tools available to higher education. The differing conceptualizations of "sustainability" complicate assessments in general and curricular assessment in particular, because an assessment requires the ability to qualify what is being assessed, and as sustainability is a contested concept in perpetual metamorphose, the assessment itself proves to be a challenging task.

This paper aims to: 1) highlight the need for discussions on the validity of assessments, and 2) discuss the potential of utilizing a supplementary course file to facilitate curricular assessments. To achieve these aims, the outcomes of two different approaches to curricular assessment (ECTS scan and instructor self-assessment via a supplementary course file) will be presented. The potential of utilizing such a course file for sustainability assessments of curricula will then be further explored. This research fits into Stephens' (2010) proposed research framework for SD in HEIs as a reflexive and prescriptive activity. Reflections on the experiences of curricular assessments at the KU Leuven university are offered, highlights the need for attention to be paid to the conceptualization of sustainability and the methodological approach chosen for curricular assessments.

A short overview of the literature will first be provided to position this research. This will commence with a brief discussion on the conceptualization of sustainability as a contested concept, which is useful to understand how epistemological issues can arise during assessments. An overview of education for sustainable development (ESD) components relevant to the case at hand will be provided. Finally, the topic of sustainability assessments in higher education will be introduced. To illustrate how different approaches to assessment can impact the outcomes of sustainability in higher education assessment, a case from the KU Leuven Faculty of Economics and Business (FEB) will be presented. Lastly, this paper will add to discussions on sustainability assessments in higher education by reflecting on the case, where different approaches to perform the assessment can greatly impact results, thus highlighting the need for further research on the validity of sustainability assessments in higher education.

1.1 Conceptualizing "Sustainability"

Despite the essential role of higher education in contributing to a sustainable society, the conceptualization of "sustainability" and, what exactly universities should do to contribute to a sustainable society, differs greatly among stakeholders (Wright, 2010; Sylvestre et al., 2013; Sylvestre et al., 2014; Urbanski and Filho, 2014). While it is not the intention of this paper to provide a single conceptualization of sustainability, or an exhaustive account of the existing

conceptualizations in literature, a short overview of some different considerations that makes sustainability a contested concept is provided in this section. This overview will briefly explore the contested nature of these concepts, and how these concepts apply to higher education. Highlighting some of the tensions of sustainability is useful for reflection on assessments further on.

While the discussion between “sustainability” (and thus, education for sustainability—EfS) and “sustainable development” (and thus, ESD) continues to be debated in the literature, the concepts will be merged, based on their commonalities, for the sake of further discussion in this paper. Thus, we keep in mind that the terms represent different viewpoints on the discourse of development, and therefore, inherent tensions exist between the terms. However, as both concepts represent an interrelatedness of social welfare, ecological health, and (to some extent) the influence of economic activities, the terms will be used interchangeably in the rest of this section.

The contested nature of this concept has not prevented it from being explored by researchers in varying fields. Connelly (2007) identified four ways in which the ambiguity of “sustainable development” is addressed in literature: 1) presenting a concept unproblematic in principle and hard to achieve in practice (i.e., a value-laden concept of what is wanted without specifying what should be done (Ziemann, 2011) —the first-level, uncontested center of the overlapping social, environmental, and economic spheres), 2) noting the ambiguity of the term, but selecting a preferred definition (commonly settling on the definition put forth in the Brundtland Report), 3) noting the ambiguity of the term and developing praxis (e.g., strong versus weak sustainability), 4) seeking to understand how “sustainable development” developed as a concept. A common thread that runs through the first three approaches is the proposal of a singular, normative conceptualization of sustainable development. Such normative conceptualizations are based on epistemological and ontological assumptions. What is considered to be “sustainability” and “sustainability in higher education” is constantly changing (Wright, 2002) and epistemological assumptions influence this (Painter-Morland, 2014). Van Oosterhout and Heugens (2008) used the concept of sustainability in the corporate world (corporate social responsibility—CSR) to illustrate how this problem of varying conceptualizations presents epistemological barriers to research. They explain that empirical research on the topic of CSR has the crippling context of trying to, “answer the positive question of what CSR is,” as a “function of the normative question of which responsibilities business organization owe society to begin with” (Van Oosterhout and Heugens 2008: 201). This can be applied to research on sustainability in higher education as well: there is tension between different normative views of what is “sustainability” and “what universities should do.” A main epistemological distinction can be made between the top-down and bottom-up approaches to sustainability. Objectivists, portraying a top-down approach to sustainability, believe something can be labelled “sustainable”. This is countered by subjectivists (a bottom-up approach to sustainability), for whom “sustainability” is a construct that is in the process of perpetual (re)creation. A plurality of conceptualizations allows for broad inclusion in the discourse on sustainability in higher education (Sylvestre et al., 2013), but this can be problematic during assessments when the assessor is required to adopt a more objectivist approach. Furthermore, some authors fear that top-down approaches to sustainability have become the dominant way of thinking, promoting a conceptualization of sustainability where system and environment are identified as being separate (Molderez, 2007).

A visual representation of the interconnectivity of environmental, social, and economic issues depicted by three overlapping circles is a familiar image to those in the field. The center where all spheres overlap suggests win-win-win scenarios and gives the impression that “sustainability”/ “sustainable development” is somehow a unitary and unambiguous concept or goal (Connelly, 2007). But this is a “first-level” understanding, and as one goes deeper into the concept, contestation becomes inherent (Connelly, 2007; Jickling, 2016). Connelly (2007) proposes mapping interpretations of the concept onto a triangle with the extreme viewpoints of economic growth, environmental protection, and social justice at each point (Figure 1). This is a useful visual aid when discussing varying conceptualizations of sustainability, as these can be mapped in relation to their alignment with the three extreme viewpoints, as well as in relation with other conceptualizations. A boundary can be drawn around conceptualizations towards the center, thus representing “sustainable

development” in the holistic sense. A concept like deep ecology (Næss, 1997), which prioritizes the environment over human welfare would be situated towards the environmental protection point of the triangle, but perhaps outside the realm of what many consider to be sustainable development. One drawback of Connelly’s triangle, is that it does not offer additional dimensions of SD, such as political or cultural dimensions (see Waas et al., 2011). Another criticism of the triangle is that it does not sufficiently emphasize the dependent relationships between the environment, society, and the economy—which alternative models account for by nesting the economy within the social realm and within the environmental realm (Giddings et al., 2002). Despite these criticisms, the triangle is useful to visualize how varying conceptualizations of sustainability can be positioned in relation to the extreme viewpoints (affected by the epistemological assumptions of their holders) and to each other. In terms of integrating sustainability into higher education curriculum, discourses relate to different epistemologies (neoclassical, ecological modernization, and ecocentric), resulting in different conceptualizations of sustainability and expectations of sustainability in higher education (Palma and Pedrozo, 2015).

Figure 1: Connelly’s Mapping of Sustainable Development (Connelly, 2007).

The roots of ESD/EfS can be credited in the environmental education (EE) movement beginning in the 1970s (Monroe, 2012). The historic roots in EE can create a tendency for conceptualizations of ESD to resort back to environmental-focused rhetoric (Lindstone et al., 2014). This can be seen in (Shriberg, 2002; Kamal and Asmuss, 2012). EE and ESD’s relation to each other varies in literature from: two separate fields, ESD encompassing EE, EE as the foundation for ESD, or a complete overlap (Eilam and Trop, 2010). Early forms of EE included social and economic dimensions as they interrelate to the environment, but the widely-adopted rhetoric of EE (from the 1980s onward) became more like a “confrontational dogma” isolating and elevating environmental themes (Monroe, 2012). Wimberley (2010) provided an example of EE as a confrontational dogma, when describing a colloquium at Florida Gulf Coast University where faculty committed to the ideology of David Orr, “consider themselves ecological missionaries dedicated to converting as many undergraduates as possible to the ‘gospel of sustainability’” (Wimberley, 2010 pp. 110). Such rhetoric can be seen as similar to that of deep ecology (discussed above), falling too close to the environmental protection point for some to consider as part of the sustainability/sustainable development discourse. While ESD has become the UN-preferred form of education to engage people in sustainable development (Jickling and Wals, 2012), it is not without criticism (Jickling, 2016). Some even call for abandoning ESD altogether and returning to more specific discourses, such as environmental education (Jickling, 2016).

1.2 Discourses in ESD

Keeping in mind the lack of consensus on ESD, this section aims to provide an overview of some major themes in ESD discourses to help position the research at hand. Within the UN Decade of Education for Sustainable Development (DESD) from 2005-2014, HEIs took steps to re-orientate

learning and teaching. Attention has been given to integrating sustainability into curricula, sustainability competencies, and pedagogies (Wals, 2014). These themes, as well as some barriers to sustainability integration in higher education, will be further explored in this section.

On a program level, the integration of sustainability into course content can be done *vertically* (sustainability integrated via specific sustainability-related courses) or *horizontally* (sustainability integrated implicitly within different regular courses of the curriculum) (Ceulemans et al., 2011; Lambrechts et al., 2013; Figueiró and Raufflet, 2015). This can be seen as a continuum with vertical integration representing the status quo, horizontal integration representing reform, and ultimate transformation of an education program would culminate at achieving transdisciplinarity (Palma and Pedrozo, 2015). Furthermore, a distinction can be made between *insertion* (a superficial or tacked-on approach), versus *integration* (full adaptation of sustainability into curricula, implemented in a holistic way) (Figueiró and Raufflet, 2015 pp. 23). Similarly, Wankel and Stoner (2009) labelled this distinction using the terms “explicit” and “implicit” sustainability integration, while Goldman et al. (2006) refer to horizontal integration as the “infusion approach”. Education is organized around disciplines (e.g., within a management program, there are courses on accounting, finance, economics, etc.). Merely inserting a sustainability course (vertical insertion) with limited connection to (and challenging of) the issues in the rest of the program would not be sufficient integration (Raufflet, 2013).

Under the influence of social constructivist theory, (higher) education increasingly adopted competency-based approaches (Van den Bergh et al., 2006), in which competencies ideally include the knowledge, skills, attitudes, and values a graduate student needs to function in society (Rychen and Salganik, 2013). Such approaches have been criticised for the many conceptual, procedural, interpersonal, and organisational problems they encounter, and especially the lack of a true holistic approach when it comes to implementing competence-based education (De Kraker et al., 2007; Stoof et al., 2007; Lambrechts and Van Petegem, 2016; Lansu et al., 2013). Within the context of higher education, general competencies for SD have been defined, in order to ensure HEIs are preparing students for the complex and uncertain context of sustainability issues (e.g. Barth et al., 2007; De Haan, 2006, 2010; Rieckmann, 2012; Wiek et al., 2011). Rieckmann (2012) defined a list of key competencies for SD, validated by international academic stakeholders, as depicted in Appendix 1. The value of SD competencies lies in the fact that they clarify the broad and blurry concept of ESD and enable educators to integrate ESD in their study program.

SD competencies in turn require new approaches in teaching and learning (Tilbury and Mulà, 2011), and a reorientation of education is needed towards more multi-, inter-, and transdisciplinarity, self-regulated learning, and project- and problem-based learning (Lambrechts et al., 2013). This transition is characterized by: 1) interactive and participative methods, 2) action-oriented methods, and 3) research-based method (Lambrechts et al., 2013). MacVaugh and Norton (2012: 74) noted the importance of active learning, as “teaching pedagogies that require the educator to privilege the learner’s participation over his or her own declarative knowledge of the subject”. In-class, active learning activities, which can contribute to the sustainability competencies, include: group work, case studies, worked examples, field research, peer teaching, project work, debate, the use of games, discussions, and service learning (Ceulemans and De Prins, 2010; MacVaugh and Norton, 2012; Figueiró and Raufflet, 2015).

1.3 Curricular Assessments

The desire to perform a curricular assessment can result from a variety of broader activities. Some HEIs choose to conduct overall higher education sustainability assessments (e.g., STARS, 2016), wherein curricular assessments are part of a larger assessment. HEIs might conduct a curricular assessment as part of quality management systems (Holm et al., 2015). Institutions that participate in Principles for Responsible Management Education (PRME) are required to report on their activities, including how sustainability is integrated in educational programs (PRME, 2016). Accreditations, such as the Association to Advance Collegiate Schools of Business (AACSB) and the European

Foundation for Management Development (EFMD), have also begin requiring organizations to report how they integrate sustainability themes in curriculum. Some HEIs prepare sustainability reports in line with the Global Reporting Initiative (GRI) guidelines, and supplement this content with information on sustainability in their educational activities (Alonso-Almeida et al., 2015; Ceulemans et al., 2015; Lozano, 2011). Curricular assessments can also be standalone activities (Lambrechts et al., 2013), perhaps aimed at developing policy, mainstreaming sustainability in a HEI, and/or improving transparency and communication (Lambrechts and Ceulemans, 2013). Regardless of why a university chooses to perform a curricular assessment, assessments can offer university leaders a starting point for change, by providing a baseline of where sustainability issues are present in the programs and where programs can be improved upon (Lozano and Young, 2013: 134-135). Presumably, as the old adage goes: what gets measured gets managed (and thus improved).

Although assessment offers key benefits to HEIs wishing to integrate sustainability, consensus has not been reached on how to assess the integration of sustainability into higher education, or what exactly to include in such assessment, as evidenced by the non-conformity of assessment tools available to higher education. Different types of assessment tools include: 1) tools that have origins in environmental management systems that involve external audits and certification, 2) tools that have open and unstandardized criteria where organizations self-assess, 3) tools that aim to generate comparative data that can be used for benchmarking across organizations, 4) tools like those in the third category but focus is on certification instead of competition across organizations (Fischer et al., 2015). In general, assessment tools provide a reference framework based on normative assumptions of how a university contributes to sustainability/what is a sustainable university, therefore, what is included in assessment tools is critical to conceptualizing what sustainability in higher education is (Fischer et al., 2015).

Previous studies have examined and compared the specific attributes of various sustainability assessment tools for higher education. Shriberg (2002) discussed the strengths and weaknesses of 11 assessment tools available at the time, comparing them to “ideal” attributes of sustainability assessment tools proposed by David Orr (Penn State Green Destiny Council, 2000), thus situating the research as environmental-sustainability focused. The research concluded that while tools are good at capturing baseline data, they fail to offer comparability across institutions and fail to offer insight into motivations as to why universities embark on sustainability activities. Saadatian et al. (2011) assessed the strengths and weakness of 18 sustainability assessment tools based on the Theory of the Triple Bottom Line and the Theory of Avoiding Subjective Judgment, thus situating their research in a holistic approach to sustainability. The authors found that the Sustainability Tracking and Assessment Rating System (STARS) and Campus Sustainability Assessment Framework (CASf) were the strongest assessment tools for novelty, comprehensiveness, popularity, and their holistic and subjective approaches to sustainability. Kamal and Asmuss (2012) explored the effectiveness of sustainability assessment tools for the University of Saskatchewan, and also found that the STARS tool was the highest rating tool for their criteria. Yarmine and Tanaka (2012) reviewed 16 tools and found that tools focus mainly on environmental impacts of university operations and issues related to governance, while aspects related to education, research, and outreach were not well addressed by sustainability assessment tools. Fischer et al. (2015) also found an over representation of operational indicators in the 12 tools included in their analysis, but based on their qualitative analysis found that, “education was introduced as a constitutive element of a sustainable university” (Fischer et al., 2015, pp. 794), thus there is a gap between what is considered to be critical to sustainability in higher education and what the tools emphasize. Sustainability assessment tools are diverse in their purpose, emphasis, and approach—stemming from different regions and political/sociocultural contexts (Fischer et al., 2015).

Despite the attention sustainability assessment tools as a whole have received in literature, there is need for more research aimed specifically at the assessment of sustainability in education. In addition, literature exploring measurement issues is weak (Karatzoglou, 2013). Further research is needed to explore issues surrounding the implementation and validity of sustainability assessment tools (Ceulemans et al., 2015).

2. Methods

The KU Leuven Master of International Business Economics and Management (MIBEM) program is used as a case study to reflect on how different curricular assessment approaches affect the results of assessment. With more than 55,000 students, the KU Leuven is the largest university in Belgium. The MIBEM program is a one-year master's program (with a six-month preparatory track) that prepares students for a career in the international business world by developing students' (business) economic acumen, knowledge, and management skills. The KU Leuven uses the European Credit Transfer and Accumulation System (ECTS), which includes information describing the course activities (with some mention of teaching approaches), its learning outcomes and credits, as well as evaluation methods and grading schemes.

In academic year 2013-2014, the MIBEM program head developed a holistic course file template. The course file is meant to provide more in-depth information about the course and how it fits into the overall program. In an attempt to gain more insight as to how sustainability is integrated into the MIBEM program, a team of internal experts in the field of sustainability and CSR developed three ESD-related sections of the course file, related to competencies, pedagogies, and sustainability themes in course content. Firstly, sustainability competencies (based on Rieckmann, 2012) were added to the course file. Secondly, pedagogical approaches were developed ranging in terms of: in-class/passive (e.g., lectures), in-class/active (e.g., discussions), out-of-class/passive (e.g., company visits), and out-of-class/active (e.g., interviews) (see Appendix 2). Lastly, sustainability themes ($n = 34$; see Appendix 3) relevant to economics and management were development based around topics included in the Global Reporting Initiatives G3 Guidelines and were augmented with concepts emphasized in the Faculty's CSR courses. This makes them specific to the Faculty's own conceptualization of sustainability/CSR.

The STARS credit AC1, dealing with sustainability in curriculum, is used as a reference for the case study. STARS, developed by the Association for the Advancement of Sustainability in Higher Education (AASHE), is a self-reporting framework intended to help colleges and universities track and measure their sustainability progress using a set of measurements (credits) (STARS, 2016). STARS Credit AC1 deals specifically with the course content, and calls on institutions to conduct an inventory of:

- 1) "sustainability courses" (courses for which the primary focus is on sustainability and/or understanding or solving one or more major sustainability challenge), and
- 2) "courses that include sustainability" (courses that are focused on a topic other than sustainability, but incorporate a unit or module on sustainability or a sustainability challenge, include one or more sustainability-focused activities, or integrate sustainability issues throughout the course) (AASHE, 2016: 36).

"Sustainability courses", in this sense, represent vertical integration of sustainability content into an educational program, as these are standalone courses that focuses on the topic of sustainability. "Courses that include sustainability" give insight into how sustainability is integrated horizontally in a study program, as these are more likely disciplinary courses that relate the main topic of the course to the concept of sustainability.

While identifying "sustainability courses" can be considered a more or less a straightforward task, identifying "courses that include sustainability" requires discretion on the part of the assessor. The STARS guidelines clarify that "courses that include sustainability" must specifically integrate sustainability or "a sustainability challenge" (AASHE, 2016: 37). For example, while chemistry is an important domain to understand certain sustainability challenges (e.g., climate change), a chemistry course that does not make explicit links to sustainability would not qualify as a "course that includes sustainability". AASHE allows each institution to choose its own methodology to categorize "courses

that include sustainability”, but does note that looking at stated learning outcomes and course objectives may “provide a richer view of sustainability course offerings than simply reviewing course descriptions, but it is not required” (AASHE, 2016: 34).

Different approaches to assess the presence of sustainability themes in course content will be used to categorize “courses that include sustainability”. As the STARS guidelines do not include specific instructions on how to identify these courses, two methods of curricula mapping will be used: a terminology scan of ECTS files and an analysis of course files developed specifically for the program. An ECTS scan for terminology is a method that has been utilized in previous literature on sustainability curricular assessments (e.g., by Ceulemans et al., 2011; Mälkki et al., 2015).

The ECTS files of all courses included in the MIBEM 2013-2014 program were screened for the presence of sustainability themes, first, using limited terminology, then expanded to be more holistic. The authors chose to use the following themes (and specific terms in italics) to verify the explicit presence of sustainability in the MIBEM program: 1) sustainability (*sustainability, sustainable development*), 2) responsibility (*responsibility, corporate social responsibility, CSR*), and 3) ethics (*ethic(s), ethical*). Based on preliminary reviews of ECTS files, terminology was further expanded to encompass additional sustainability-related topics harvested from the ECTS files themselves, organized into additional sustainability-related themes: 4) stakeholder inclusiveness (*stakeholder*); 5) market failure (*market failure, externalities, common resources*); 6) environment-related terms (*ecology, environment, planet, green*); and 7) society-related terms (*socio-economic, society, social welfare, human rights, labor* [in the context of labor rights], (*un*)employment, (*in*)equality, diversity).

Parallel, a review of supplementary course files, developed by the Faculty, were used to categorize “course that include sustainability”. The course files include explicit checkboxes for different sustainability themes (n = 34). Instructors are therefore able to self-assess and link the content of their course to any and all of the 34 sustainability themes included in the course file. The results of these two methods will be compared, and the outcomes will be discussed. The STARS tool is meant for sustainability assessment of any higher education program, therefore, the lessons learned from assessment approaches in this research can also be applied to assessment in any other program.

Next, the two different approaches (ECTS and course files) were used to assess what pedagogies were being utilized by instructors in their courses. The list of pedagogies developed by the Faculty were also used to categorize the teaching approaches described in both ECTS and course files.

Lastly, the presence of SD competencies in the program were assessed. The MIBEM program has a program-wide competency scheme, but ECTS files do not make explicit which competencies are covered in specific courses. Therefore, the program-wide competency scheme is use in addition to the course files to examine the presence of SD competencies in the program.

The courses “Business Research Methods”, “Research Proposal Master Thesis”, and “Master Thesis MIBEM” have been excluded from the research, as these courses are meant to guide students in the development of their individual master theses and are not structured in a way that makes their content comparable to other courses. Three courses are excluded from the course file analysis, as instructors failed to complete the course file. Therefore, of the 26 courses of the program, 23 are included in the ECTS scan and 20 are included in the course file analysis (see Figure 3).

SUSTAINABILITY THEMES IN COURSE CONTENT

ECTS scan

Sustainability	Responsibility	Ethics	Stakeholder inclusiveness
<i>Sustainability, sustainable development</i>	<i>Responsibility, corporate social responsibility, CSR</i>	<i>Ethic(s), ethical</i>	<i>Stakeholder</i>
Market failure	Environmental	Societal	
<i>Market failure, externalities, common resources</i>	<i>Ecology, environment, planet, green</i>	<i>Socio-economic, society, social welfare, human rights, labor, (un)employment, (in)equality, diversity</i>	

Course file

PEDAGOGIES

ECTS scan

ESD COMPETENCIES

MIBEM Competency Scheme

Course file

Figure 2: Assessment approaches.

3. Results

Courses that reference sustainability themes in the course content are categorized as STARS AC1 “courses that include sustainability”. Out of 23 courses included in the ECTS scan, 8 courses could be labelled as “courses that integrate sustainability” when using the initial terms, and 13 courses could be labelled as such when using the expanded terminology (34.8% and 56.5%, respectively; see Figure 3). When asked explicitly if their course deals with specific sustainability themes in the course file, instructors are more inclined to link their course to sustainability. Of the 20 courses included in the assessment, 19 courses could be labelled as “courses that include sustainability” (95% of courses). It is clear that the approach used to assess the integration of sustainability in courses drastically influences the results. An overview of these results is presented below in Figure 3.

Figure 3: Sustainability themes in course content of the MIBEM program.

While the results are no doubt affected merely by increasing the themes of sustainability included in assessment (i.e., more themes are included in the course file than in the ECTS scan), the use of a course file to better capture ESD can also be seen when dealing with specific topics. When instructors were asked specifically in the course file if their course integrates “ethics”, 6 courses are said to (30%), compared to just 2 courses (8.6%) if relying solely on an ECTS scan.

It is also interesting to examine how sustainability is represented in a program (i.e. conceptualizing). Based on the ECTS scan (Figure 4): 3 courses integrate sustainability (13%), 3 courses integrate responsibility (13%), 2 courses integrate ethics (8.7%), 6 courses integrate environmental themes

(26%), 3 courses integrate stakeholder inclusiveness (13%), 3 courses integrate market failure (13%), and 9 courses integrated societal themes (39%). Based on the course file (Figure 5), the most prominent theme in MIBEM curricula is “social value creation”, with 12 courses integrating this theme (60%). Thus, regardless of approach, the societal element of sustainability is most represented in the MIBEM program.

Figure 4: Prevalence of sustainability themes in course content of KU Leuven MIBEM program based on ECTS files.

Figure 5: Prevalence of sustainability themes in course content of KU Leuven program based on supplementary course file.

3.1 Additional insights from a course file

The course file also provides valuable insight into ESD integration in the program beyond STARS AC1. The course file asked instructors to self-assess what SD competencies are present in a study program. Based on the results of the course file assessment, all instructors reported at least one SD

competency represented in their course, and every one of Rieckmann's SD competencies are present in at least two courses (see Figure 6). The SD competency most prevalent in the MIBEM program was that of "critical thinking" (present in 19 courses). The MIBEM program has its own program-wide competency scheme, but ECTS files for individual courses do not include which of these competencies is covered in each course. The MIBEM-wide competency scheme includes the following of Rieckmann's SD competencies: dealing with complexity, cooperation in (heterogeneous) groups, interdisciplinary work, communication and use of media, and evaluation. In addition, this program-wide scheme includes the competency: *Possesses managerial and entrepreneurial skills, applied within an international business context, with attention to social and ethical aspects*. Since the ECTS files do not mention the specific competencies covered in individual courses, course files prove vital in assessing the presence of SD competencies in specific courses of a program.

Figure 6: Prevalence of sustainability competencies in MIBEM program, based on course file analysis.

The course file also provides a better insight into the pedagogies used in a course than relying on an ECTS scan. Figure 7 illustrates the various teaching methods utilized in the MIBEM program, and clearly highlights that course files better capture pedagogies. Although lectures remain the most commonly used pedagogy, a variety of active/in-class methods are being utilized in the MIBEM program.

Figure 7: Prevalence of pedagogies used in the MIBEM program.

4. Discussion

The case at hand presented two approaches to sustainability assessment of curricula, and discusses validity issues related to them (which was identified as an area in need for further research, see Ceulemans et al., 2015). Regardless of the approach used, the conceptualization of “sustainability” during the assessment impacts the extent to which sustainability is perceived as being integrated in the curricula. In the case, the terms included in the ECTS scan were initially just sustainability, ethics, and CSR. Using this limited approach, only 8 courses would be categorized as “courses that include sustainability, but with an expanded approach (including stakeholder inclusiveness, market failure, environmental concern, and social welfare), 19 courses could be categorized as “courses that include sustainability”. This is a stark difference that raises questions about the validity of assessments and the meaningfulness of their results.

In this context, it is useful to refer back to Connelly’s (2007) triangle as a way to map varying conceptualizations of sustainable development. If one takes the stance that sustainability only exists in the overlap of social, environmental, and economic topics, then the assessment should capture explicit sustainability. However, if the conceptualization of sustainability is drawn wider than just the overlap, then an assessment should also capture topics positioned slightly closer to the three extreme viewpoints that may (or may not) interact with other viewpoints (i.e., standalone environmental issues). It is not the intention of this research to propose either approach, but to highlight how varying conceptualizations of sustainability impact approaches to, and results of, sustainability assessments.

Let us consider two platforms on which varying conceptualizations of sustainability can impact the results: the individual and the organizational level. As in the case presented in this paper, the assessment can be left in the hands of a specific individual (in this case, the Sustainability Coordinator of the Faculty). This individual will have his/her own conceptualization of sustainability based on his/her ideological position, which will inevitably have an impact on how the assessment is carried and what is included in the results. While it may improve the validity of the results to have ECTS files reviewed by multiple persons, in reality, time and budget constraints may inhibit this. On the level of the organization (in this case, an economics and business faculty), there will be dominant ideologies based on the epistemological and ontological positioning of the field and impacted by the local context and the individual instructors involved. These dominant ideologies impact where the boundary around sustainability/sustainable development is perceived. An interesting finding from the case is the emphasis on social/societal welfare in the Faculty's courses. Further research could explore the extent to which characteristics of the faculty (e.g., its location in a socialist democracy) contribute to its ideological positioning on Connelly's (2007) triangle, but that is beyond the scope of the current research. If the assessment had emphasized environmental sustainability, as some tools do (e.g., Shriberg, 2002; Kamal and Asmuss, 2012; Yarmine and Tanaka, 2012), then the perceived integration of sustainability in the program may have been perceived as lower.

When attempting a curricular assessment, the approach used can create (at times dramatically) different results, even if used within the context of one STARS credit (AC1). Part of this difference can be attributed to the comprehensiveness of the course file. For example, the course file includes 34 sustainability-related terms, while the ECTS scan included only seven themes (with around 17 explicit terms). However, as seen in the case, even when dealing with a specific theme (e.g., "ethics"), the course file approach provided more comprehensive results. ECTS files are meant to be brief overview files. In the case at hand, ECTS files varied in terms of length and level of detail in which the course content is described. If an ECTS file does not include detailed content, the validity of the assessment will be impacted. As seen in the case, the course "Human Resource Management" was not identified as including social themes because the content of ECTS file is minimal (with in this case only the presence of titles of various subtopics of the course). While in reality, this course most likely is dealing with social welfare issues, it is not captured in the results of ECTS file scan. Even if ECTS files describe the course in detail, the assessor(s) (not the instructor) is interpreting the contents. Issues can arise with this. One issue is the ambiguity of terms. For example, the term "environment" can have multiple meanings (natural environment versus business environment). This may be resolved by the assessor reading the context of each term, but even then it may not be clear. Correct interpretation of ECTS files can require the assessor to be familiar with the field (i.e., when is discussion about stakeholders part of sustainability?). Course files, on the other hand, offer a way to systematically capture information on each course by means of checkboxes. Since instructors are self-assessing, there is less potential guessing involved regarding the course context. Moreover, the active engagement of instructors in the assessment process may increase the SD awareness of the instructors involved, which is an important condition for affecting change towards SD (Ceulemans and De Prins, 2010; Maloni et al., 2012; Rusinko, 2010).

A course file can also be useful in capturing ESD elements beyond the scope of the STARS credits, e.g. pedagogies and SD competencies. The MIBEM program has a program-wide competency scheme, wherein is a specific competency dealing with sustainability, specifically societal and ethical aspects (KU Leuven, 2016). However, the program-wide scheme does not identify which courses deal with specific competencies, nor is this information included in the ECTS files of the program. While some pedagogies are mentioned in certain ECTS files, these are not presented in a detailed way. Again, the course files offer a more systematic method to capture ESD information on each course.

Despite the potential advantages of using a course file, issues remain with both assessment approaches. The presence of sustainability themes, SD competencies, or pedagogies in a course does not necessarily equate to ESD *integration*. Despite the assets, lists of SD competencies are often criticised for being too static, missing opportunities for a holistic approach, or simply for being mere

“laundry lists” of competencies without considerable attention to the implications for the learning process (see Lambrechts and Van Petegem, 2016). The possibility to assess certain attitudes and values related to SD remains a difficult, but important aspect of the integration of sustainability competencies (Cebrián and Junyent, 2015; Lambrechts, 2016). However, neither approach would measure the extent to which students gain SD competencies, nor would it measure if active learning pedagogies actually privilege the learner’s participation over the instructor’s own declarative knowledge of the subject.

While there is an attempt in STARS to value horizontal versus vertical integration of SD on the program level (as discussed in Section 1.2), it is limited. Institutions receive credits if 20% or more of all courses offered by the institution are sustainability courses and/or courses that include sustainability (horizontal integration), as well as credits if 90% or more of academic departments or their equivalent offer at least one sustainability course or course that includes sustainability (vertical integration). However, there is no valuation as to the weight of sustainability themes in “courses that include sustainability”. Nor do ECTS scans, the use of a course file, or the STARS tool as a whole include elements to measure the inter- or transdisciplinarity of sustainability integration as called for by Lambrechts et al. (2013) and Raufflet (2013). If true ESD integration is more than the mere presence of sustainability issues in course content, one can raise the question: do HE sustainability assessments for curriculum really measure what they intend to—ESD *integration*? The case at hand points to major limitations of assessments to do this.

5. Conclusion

While curricular assessments can offer a starting point for change and input for reporting of ESD integration, the way assessment tools are applied (i.e. the approach) can widely impact the results. The varying conceptualizations of “sustainability”, only add to the complexity of assessments. Relying on course overview files (such as ECTS) to assess the sustainability of curricula is a common method for HEIs, but this can be a limiting approach. A complementary course file can be a useful tool for assessors to gain a more holistic picture of how courses are contributing to HE for SD (e.g., presence of sustainability themes in course content, sustainability competencies, and pedagogies), as well as a method of sensitization for instructors to conceptualize sustainability in a more holistic manner, but there remain limitations to this approach as well. There is still room for improvement on existing assessment tools to measure true integration. For example, while STARS AC1 attempts to account for horizontal sustainability integration by including “courses on sustainability”, there is no assessment of the weight these themes get in the courses (e.g., portion of class time devoted to the theme), how courses are interrelated across a program, or how elements of ESD interact (e.g., course content and pedagogies).

As HEIs are increasingly being asked to report (e.g., from accreditation bodies, governments, students), or are voluntarily reporting on the extent to which they integrate sustainability, more attention needs to be paid to the issue of assessment (and in turn, reporting) approaches. The findings presented here confirm Ceulemans, et al.’s (2011) position that further research is needed on continuing to develop meaningful assessment approaches for HEIs. Specific attention will need to be given as to whether tools are measuring a holistic ESD integration versus the mere presence of ESD elements in a program. In this sense, it would be useful to distinguish between SD integration via “inputs” (e.g., curriculum content, pedagogy) and “outputs” (e.g., acquired competencies or learning objectives), since the final aim of ESD is to deliver graduates that are able to foster the transition towards a sustainable society.

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References

- Alonso-Almeida M. M., Marimon F., Casani F. and Rodriguez-Pomeda J. (2015). "Diffusion of sustainability reporting in universities: current situation and future perspectives". *Journal of Cleaner Production*, 106, 144–154.
- Association for the Advancement of Sustainability in Higher Education (AASHE). 2016. Sustainability Tracking, Assessment & Rating System (STARS) Technical Manual version 2.1.
- Barth, M., Godemann, J., Rieckmann, M., & Stoltenberg, U., 2007. Developing key competencies for sustainable development in higher education. *International Journal of Sustainability in Higher Education*. 8(4), 416–430.
- Cebrián, G. and Junyent, M., 2015. Competencies in Education for Sustainable Development: Exploring the Student Teachers' Views. *Sustainability*. 7(3), 2768-2786.
- Ceulemans, K. and De Prins, M., 2010. Teacher's manual and method for SD integration in curricula. *Journal of Cleaner Production*, 18, 645-651.
- Ceulemans, K., De Prins, M., Cappuyns, V., and De Coninck, W., 2011. Integration of sustainable development in higher education's curricula of applied economics: Large-scale assessments, integration strategies and barriers. *Journal of Management and Organization*. 17(5), 621-640.
- Ceulemans, K., Molderez, I. and Van Liedekerke, L., 2015. Sustainability Reporting in Higher Education: A Comprehensive Review of the Literature and Paths for Further Research. *Journal of Cleaner Production*. 106, 127-143.
- Connelly, S. 2007. Mapping sustainable development as a contested concept. *Local Environment*. 12(3), 259-278.
- De Haan, G., 2006. The BLK '21' programme in Germany: a 'Gestaltungskompetenz'-based model for education for sustainable development. *Environmental Education Research*. 12, 19-32.
- De Kraker, J., Lansu, A. and van Dam-Mieras, M.C. 2007. Competences and competence-based learning for sustainable development. In: De Kraker, J., Lansu, A. and van Dam-Mieras, M.C. (eds.), *Crossing boundaries. Innovative learning for sustainable development in higher education*, Verlag für Akademische Schriften, Frankfurt am Main, 103-114.
- de Lange, D. E., 2013. How do universities make progress? Stakeholder-related mechanisms affecting adoption of sustainability in university curricula. *Journal of Business Ethics*. 118(1), 103-116.
- Disterheft, A., Caeiro, S., Azeiteiro, U.M., and Filho, W.L., 2013. Sustainability Science and Education for Sustainable Development in Universities: A Way for Transformation. In Caeiro, S. et al (eds), *Sustainability Assessment Tools in Higher Education Institutions*.
- Eilam, E. and Trop, T., 2010. ESD Pedagogy: A Guide for the Perplexed. *The Journal of Environmental Education*. 42(1) 43-64.
- Fernández-Sánchez, G., Bernaldo, M. O., Castillejo, A. and Manzanero, A. M., 2014. Education for Sustainable Development in Higher Education: State-of-the-Art, Barriers and Challenges. *Higher Learning Research Communications*. 4(3), 3-11.

- Figueiró, P.S. and Raufflet, E., 2015. Sustainability in higher education: a systematic review with focus on management education. *Journal of Cleaner Production*. 106: 22-33.
- Fischer, D., Jenssen, S., and Tappeser, V., 2015. Getting an empirical hold of the sustainable university: a comparative analysis of evaluation frameworks across 12 contemporary sustainability assessment tools. *Assessment & Evaluation in Higher Education*. 40(6), 785–800.
- Gale, F., Davidson, A., Wood, G., Williams, S., and Towle, N. 2015. Four impediments to embedding education for sustainability in higher education. *Australian Journal of Environmental Education*. 31(2), 248-263.
- Giddings, B., Hopwood, B. and, O'Brien, G., 2002. Environment, economy and society: Fitting them together into sustainable development. *Sustainable Development*. 10, 187-196.
- Goldman, D., Yavetz, B., and Pe'er, S. 2006. Environmental literacy in teacher training in Israel: Environmental behaviour of new students. *The Journal of Environmental Education*. 38(1), 3-22.
- Higgins, B. and Thomas, I. 2016. Education for Sustainability in Universities: Challenges and Opportunities for Change. *Australian Journal of Environmental Education*. 32(1), 91-108.
- Holm, T., Sammalisto, K., Grindsted, T.S., Vuorisalo, T. 2015. Process framework for identifying sustainability aspects in university curricula and integrating education for sustainable development. *Journal of Cleaner Production*. 106, 164-174.
- Jickling, B. 2016. Losing traction and the art of slip-sliding away: Or, getting over education for sustainable development. *The Journal of Environmental Education*. 47(2), 128-138.
- Jickling, B. and Wals, A. E. J. (2008). Globalization and environmental education: looking beyond sustainable development. *Journal of Curriculum Studies*. 40(1), 1–21.
- Jickling, B. and Wals, A. 2012. Debating Education for Sustainable Development 20 Years after Rio: A Conversation between Bob Jickling and Arjen Wals. In *ESD in Higher Education, the Professions and at Home*. Sage Publications. 6(1), 49-57.
- Kamal, A. and Asmuss, M., 2013. Benchmarking tools for assessing and tracking sustainability in higher educational institutions: Identifying an effective tool for the University of Saskatchewan. *International Journal of Sustainability in Higher Education*. 14(4), 449-465.
- Karatzoglou, B., 2013. In in-depth literature review of the evolving roles and contributions of universities to Education for Sustainable Development. *Journal of Cleaner Production*. 49, 44-53.
- KU Leuven, 2016. Learning outcomes and key objectives MIBEM 2014-2015, available here: https://feb.kuleuven.be/brussel/studenten/documenten-studenten/2014_2015_doelstellingenkaderMIBEB_M_ENG.pdf (accessed July 6, 2016).
- Lambrechts, W., Mulà, I., Ceulemans, K., Molderez, I., & Gaeremynck, V., 2013. The integration of competences for sustainable development in higher education: an analysis of bachelor programs in management. *Journal of Cleaner Production*. 48, 65-73.
- Lambrechts, W. and Ceulemans, K., 2013. Sustainability assessment in higher education: Evaluating the use of the Auditing Instrument for Sustainability in Higher Education. In: Caiero, S., Leal Filho, W., Jabbour, C. and Azeiteiro, U. (eds.). *Sustainability assessment tools in higher education institutions – Mapping trends and good practices at universities around the world*. Springer International Publishing, Switzerland, 157–174.

Lambrechts, W., Van Petegem, P., 2016. The interrelations between competences for sustainable development and research competences. *International Journal of Sustainability in Higher Education*, in press17 (6), 776-795.

Lambrechts, W., 2016. Possibilities and practices of competences for sustainable development in higher education. In: Lambrechts, W., Hindson, J. (Eds.), *Research and Innovation in Education for Sustainable Development. Exploring collaborative networks, critical characteristics and evaluation practices*. Environment and School Initiatives – ENSI, ZVR-Zahl 408619713, Vienna, Austria.

Lansu, A., Boon, J., Sloep, P. B., and van Dam-Mieras, R. (2013). Changing professional demands in sustainable regional development: a curriculum design process to meet transboundary competence. *Journal of Cleaner Production*, 49, 123-133.

Lindstone, L., Wright, T. and Sherren, K., 2014. Canadian STARS-Related Campus Sustainability Plans: Priorities, Plan Creation and Design. *Sustainability*. 7, 725-746.

Lozano, R., 2006. A tool for a Graphical Assessment of Sustainability in Universities. *Journal of Cleaner Production*. 14, 963-972.

Lozano R. (2011). The state of sustainability reporting in universities. *International Journal of Sustainability in Higher Education*, 12, 1, 67–78.

Lozano, R., Ceulemans, K., Alonso-Almeida, M., Huisingh, D., Lozano, F.J., Waas, T., Lambrechts, W., Lukman, R. and Hugé, J., 2015. A review of commitment and implementation of sustainable development in higher education: results from a worldwide survey. *Journal of Cleaner Production*. 108, 1-18.

Lozano, R. and Young, W., 2013. Assessing sustainability in university curricula: exploring the influence of student number and course credits. *Journal of Cleaner Production*. 49, 134-141.

Lukman, R. and Glavič, P., 2006. What are the key elements of a sustainable university? *Clean Technologies and Environmental Policy*. 9(2), 103–114.

MacVaugh and Norton, 2012. Introducing Sustainability into Business Education Contexts Using Active Learning. *International Journal of Sustainable Higher Education*. 13(1), 72-87.

Mälkki, H., Alanne, K., Hirsto, L., 2015. Method to quantify the integration of renewable energy and sustainability in energy degree programmes: a Finnish case study. *Journal of Cleaner Production*. 106, 239-246.

Maloni, M.J., Smith, S.D. and Napshin, S., 2012. A methodology for building faculty support for the United Nations Principles for Responsible Management Education. *Journal of Management Education*. 36(3), 312-336.

Molderez, I. (2007). Spirits of Ecological Thinking. *International Journal of Innovation and Sustainable Development*, 2 (3-4), 376-394.

Monroe, M., 2012. The Co-Evolution of ESD and EE . Sage Publications. 6(1), 43-47.

Næss, A. (1997) Sustainable development and the deep ecology movement. In, S. Baker, M. Kousis, D. Richardson & S. Young (Eds) *The Politics of Sustainable Development*, (London, Routledge).

- Painter-Morland, M. 2014. Philosophical assumptions undermining responsible management education. *Journal of Management Development*. 34(1), 61-75.
- Palma, L.C. and Pedrozo, E. 2015. Complex matrix for the analysis of sustainable transformative learning: an assessment methodology of sustainability integration in universities. *Assessment & Evaluation in Higher Education*. 40(6), 817-832.
- Penn State Green Destiny Council. 2000. Penn State Indicators Report 2000: Steps toward a Sustainable University. State College, PA.
- PRME, 2016. A basic guide to the Sharing Information on Progress (SIP), available here: <http://www.unprme.org/resource-docs/SIPToolkitFINALWeb.pdf>.
- Ramos, T., Caeiro, S., van Hoof, B., Lozano, R., Huisingh, D., Ceulemans, K., 2015. Experiences from the implementation of sustainable development in higher education institutions: Environmental Management for Sustainable Universities. *Journal of Cleaner Production*. 106 (3), 3-10.
- Raufflet, E. 2013. Integrating Sustainability in Management Education. *Humanities*. 2, 439–448.
- Rieckmann, M., 2011. Schlüsselkompetenzen für eine nachhaltige Entwicklung der Weltgesellschaft. Ergebnisse einer europäisch-lateinamerikanischen Delphi-Studie. *GAIA*. 20(1), 48–56.
- Rieckmann, M., 2012. Future-oriented higher education: Which key competencies should be fostered through university teaching and learning? *Futures*. 44(2), 127–135.
- Rusinko, C.A., 2010. Integrating sustainability in management and business education: A matrix approach. *Academy of Management Learning and Education*. 9(3). 507-519.
- Rychen, D.S. and Salganik, L.K. (eds.) (2003), *Key Competencies for a Successful Life and a Well-Functioning Society*. Hogrefe & Huber, Göttingen.
- Ryan, A. and Tilbury, D., 2013. Uncharted waters: voyages for Education for Sustainable Development in the higher education curriculum. *The Curriculum Journal*. 18(2), 272-294
- Saadatian, O., Dola, K. B. and Tahir, O. M., 2011. Identifying Strengths and Weakness of Sustainable Higher Educational Assessment Approaches. *International Journal of Business and Social Science*. 2(3), 137-146.
- Shriberg, M., 2002. Institutional assessment tools for sustainability in higher education: Strengths, weaknesses, and implications for practice and theory. *Higher Education Policy*. 15, 153-167.
- Shiel, C., Leal Filho, W., do Paço, A., and Brandli, L. 2015. Assessing and evaluating sustainable development in higher education. Guest Editorial: Assessment and Evaluation in Higher Education. 40(6), 783-784.
- Stephens, G. and Graham, A., 2010. Toward an empirical research agenda for sustainability in higher education: exploring the transition management framework. *Journal of Cleaner Production*. 18, 611-618.
- Stubbs, W. and Cocklin, C., 2008. Teaching sustainability to business students: shifting mindsets. *International Journal of Sustainability in Higher Education*. 9(3), 206-221.
- Stoof, A., Martens, R.L. and van Merriënboer, J.J.G. (2007), “Web-based support for constructing competence maps: design and formative evaluation”, *Educational Technology Research and Development*, 55 (4), 347-368.

Sylvestre, P., Wright, T., and Sherren, K. 2013. Exploring faculty conceptualizations of sustainability in higher education: cultural barriers to organizational change and potential resolutions. *Sage Publications*. 7(2), 223-224.

Sylvestre, P., Wright, T. and Sherren, K., 2014. A Tale of Two (or More) Sustainabilities: A Q Methodology Study of University Professors' Perspectives on Sustainable Universities. *Sustainability*. 6(3), 1521-1543.

Thomas, I., 2004. Sustainability in tertiary curricula: what is stopping it happening? *International Journal of Sustainability in Higher Education*. 5(1), 33-47.

Tilbury, D. and Mulà, I. 2011. (eds.). *National Journeys towards Education for Sustainable Development*. UNESCO, Paris.

Urbanski, M. and Filho, W., 2014. Measuring sustainability at universities by means of Sustainability Tracking, Assessment and Rating Systems (STARS): early findings from STARS data. *Environment, Development and Sustainability*. 17(2), 209-220.

Van den Bergh, V., Mortelmans, D., Spooren, P., Van Petegem, P., Gijbels, D. and Vanthournout, G. (2006), "New assessment modes within project-based education – the stakeholders", *Studies in Educational Evaluation*, 32, 345-368.

van Oosterhout, J. and Heugens, P. 2008. Much Ado about Nothing: A Conceptual Critique of Corporate Social Responsibility. In, Crane, A., Matten, D., McWilliams, A., Moon, J. and Siegel, D. (Eds) *The Oxford Handbook of Corporate Social Responsibility*. Oxford University Press. Oxford, UK.

Verhulst, E. and Lambrechts, W., 2015. Fostering the incorporation of sustainable development in higher education. Lessons learned from a change management perspective. *Journal of Cleaner Production*. 106: 189-204.

Waas, T., Hugé, J., Verbruggen, A., and Wright, T., 2011. Sustainable Development: A Bird's Eye View. *Sustainability*. 3, 1637-1661.

Wals, A., 2014. Sustainability in higher education in the context of the UN DESD: a review of learning and institutionalization processes. *Journal of Cleaner Production*, 62, 8-15.

Wankel, C. and Stoner, J., 2009. *Management Education for Global Sustainability*. Information Age Publishing, Charlotte.

Wiek, A., Withycombe, L., & Redman, C. L., 2011. Key competencies in sustainability: a reference framework for academic program development. *Sustainability Science*. 6(2), 203–218.

Wimberley, T., 2010. Pluralism Lost: Sustainability's Unfortunate Fall. *Academic Questions*. 23(1), 102-111.

Wright, T. (2002). *Policy, change and environmental sustainability in a university*. PhD thesis, University of Alberta, Canada.

Wu, Y.-C.J., Huang, S., Kuo, L. and Wu, W.-H. (2010). Management education for sustainability: A web-based content analysis. *Academy of Management Learning and Education*, 9(3), 520-531.

Wright, T., 2010. University presidents' conceptualizations of sustainability in higher education. *International Journal of Sustainability in Higher Education*. 11(1), 61-73.

Yarime, M. and Tanaka, Y., 2012. The Issues and Methodologies in Sustainability Assessment Tools for Higher Education Institutions: A Review of Recent Trends and Future Challenges. *Journal of Education for Sustainable Development*. 6(1), 63–77.

Ziemann, A. 2011. Communication theory and sustainability discourse. In Godemann, J and Michelsen, G. (eds.) *Sustainability Communication: Interdisciplinary Perspectives and Theoretical Foundations*. Springer Science + Business Media.

Appendix 1: Sustainability competencies (Source: adapted from Rieckmann, 2011, 2012).

Competency	Description
Systemic thinking and handling of complexity	ability to identify and understand connections; think connectively; be able to deal with uncertainty
Anticipatory thinking	develop visions, apply precautionary principle, and predict flows of (re-) action; be able to deal with risks and changes
Critical thinking	ability to look at the world, challenge norms, practices, and opinions; reflect on one's own values and actions; give opinions to others; understand external perspectives.
Acting fairly and ecologically	know alternative actions; be able to orientate oneself in regards to justice, solidarity, and conservation values; reflect on possible outcomes of one's actions; take responsibility for one's actions
Cooperation in (heterogeneous) groups	ability to deal with conflicts; to learn from others; be able to show understanding/sympathy
Participation	ability to identify scopes of creativity and participation; be able to participate in the creation of initiatives
Empathy and change of perspective	Ability to identify onesown external perspectives; to deal with onesown and external value orientation; to put oneself in someone else's position; be able to accept diversity
Interdisciplinary work	ability to deal with knowledge and methods of different disciplines and be able to work on complex problems in interdisciplinary contexts
Communication and use of media	ability to communicate in intercultural contexts; to deal with IT; to be able to pass criticism on media
Planning and realising innovative projects	develop ideas and strategies; plan and execute projects; show willingness to learn for innovation; ability to deal with, and reflect on possible risks
Evaluation	ability to elaborate evaluation standards and carry out independent evaluations with respect to conflicts of interest and goals, uncertain knowledge, and contradictions
Ambiguity and frustration tolerance	conflicts, competing goals and interests, contradictions, and setbacks

Appendix 2: Pedagogical approaches included in the MIBEM course file.

- Passive learning
 - In class
 - Formal lectures
 - Guest lectures
 - Research
 - Forum/discussion panels
 - Cases discussed by teacher
 - Blended learning
 - Online discussions
 - Film screenings
 - Out of class
 - Guided city tours
 - Company visits
 - Participation in roundtables/ company stakeholder meeting
- Active learning
 - In Class
 - Group discussion with reporting
 - Questions
 - Brainstorming
 - Teaching-learning conversation
 - Voting
 - Simulation games
 - Class discussions
 - Cases processed by students
 - Group work
 - Self-study
 - Project planning on computer
 - Out of class
 - Interviews
 - Internships

Appendix 3: Sustainability themes included in the MIBEM Course File.**Corporate Responsibility**

1. Business Ethics
2. Corporate governance
3. Labor practices
4. Stakeholder Inclusiveness
5. Pro Bono Engagement
6. Diversity and Equal Opportunity
7. Ethical Investments
8. Health and Safety
9. Environmental Management & Responsibility
10. Sustainable/Social Entrepreneurship
11. Social value creation
12. Sustainable Business Models

Equity

13. Globalization
14. Food Security
15. Urbanization
16. Activism
17. Health
18. Human Rights / Diversity
19. Poverty

Dealing with complexity and transdisciplinarity

20. Complexity leadership / leadership for sustainability
21. Social economy (including NGOs)
22. Multi-actor collaboration
23. Transition management
24. Social-ecological resilience
25. Spirituality and philosophy with respect to sustainability
26. Alternative, indigenous concepts of sustainability

Ecology/Green Technology

27. Natural resources
28. Pollution
29. Greenhouse gases/climate change
30. Energy
31. Mobility
32. Materials Management
33. Waste Management
34. Process Optimization