A

Accessibility

► Sustainable Mobility

Accountability and Sustainable Development

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Definition

Accountability is a term that has been widely discussed and is defined as, "The duty to provide an account or reckoning of those actions for which one is held responsible. Accountability has two crucial components: it arises as a result of a relationship between two or more parties (be the individual, loose associations or organizations) and its nature is determined by the social and moral context in which the relationship is manifest" (Gray et al. 2014: 50). Accountability is often overlapped with other related concepts, such as transparency, responsibility, and clarity (Bovens 2007).

Linkage Between Accountability and Sustainable Development to MNCs

According to the above definition of accountability, each individual will have an innumerable relationship with different individuals, parties, and organizations. Each relationship could be in different purposes. What is considered acceptable behavior in the relationship? Different customs, different cultures, and different socioeconomic systems will have different acceptable standards and practices (Gray et al. 2014). The combination of the nature of the relationship and the certain form of governing the relationship in the context is called "ethic of accountability" that is suggested by Dillard (2007). Each particular relationship has a moral aspect strongly determined by the certain expectations and the nature of the relationship (Gray et al. 2014). In particular, one feature of this moral aspect is to provide "accounts" to elucidate one's behavior, to express one's intentions, and to provide justification of one's intended actions (Gray et al. 2014). We always undertake accountability in various degrees of transparency, responsibility, and formality (Gray et al. 2014). These accounts could be broadly divided into two accounts: informal accounts and formal accounts (Gray et al. 2014). Informal accounts refer to Rawls's (1972) "closeness" that is an intimacy, a physical closeness, and moral proximity between two or more parties, whereas formal accounts

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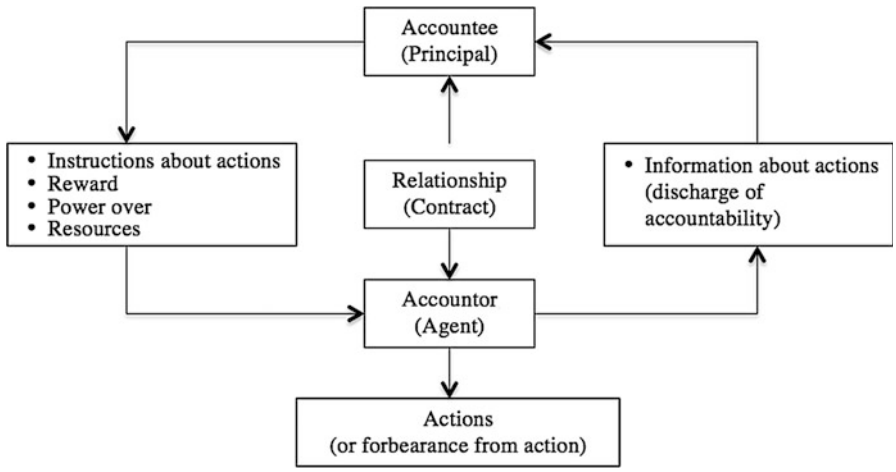
normally require some formality in a written form, for example, public statements (Gray et al. 2014).

Accountability usually involves two major responsibilities: an accountee (the responsibility to take certain actions) and an accountor (the responsibility to offer an account of those actions) (Gray et al. 2014). A simple model of accountability (Fig. 1) illustrates the relationship between an accountee (the principal) and an accountor (the agent) suggested by Gray et al. (2014). The flows between the two parties will take accountability and actions. The flows can be seen a function of the relationship between the parties (or a "contract" between the two parties) (Gray et al. 2014). The contract could be referred to "the Companies Acts" in the business setting. The Companies Acts show the social context of the relationship between the accountee and the accountor who may be individuals, groups, or organizations in the simple model of accountability as shown in Fig. 1 (Gray et al. 2014).

Applying this model to the simple structure of an organization at the senior management level, this model shows the relationship between the principal (shareholders) and the agents (directors of a company). Shareholders often give instructions and expectations about certain actions to directors of a corporation, such as profit maximization, project investment, and maximizing shareholders value. If directors could meet certain targets set by shareholders, directors will receive monetary reward for return. Shareholders could have power to take over resources. By contrast, directors of a corporation normally have a responsibility to provide an account or information about certain actions on how they manage their business operation. In other words, directors should be accountable to shareholders, manage the company on behalf of shareholders, and act for shareholders' interests. This relationship is typically based on economic incentives or financial objectives and requires formal accounts, i.e., the rules, regulations, and legislations. However, agency problems develop when directors pursue self-interest over shareholders' interests.

How is accountability related to sustainability? The following paragraphs provide a brief overview of sustainability or sustainable development. According to the World Commission on Environment and Development (WCED 1987: 43), sustainable development has been widely defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Sustainability and sustainable development have gradually received an attention in the early 1990s. In 1992, the United Nations organized the Conference on Environment and Development at Rio de Janeiro in Brazil to discuss environmental policies and subsequently received approximately 170 signatures from



Accountability and Sustainable Development, Fig. 1 The simple model of accountability (Source: Gray et al. 2014, p. 52)

various countries (Blowfield and Murray 2014). Notably, the Earth Summit and Agenda 21 were a crucial step to enhance the development of environmental policies. In 1997, the United Nations held a summit in Kyoto (Japan) to impose countries to follow a protocol to reduce greenhouse gas emission (Blowfield and Murray 2014).

Based on the successful achievement and accomplishment of the Millennium Development Goals (MDGs), the United Nations continued to establish the extended version of 17 Sustainable Development Goals (SDGs) of the 2030 Agenda (The United Nations 2017b). In particular, the goal 17 states "Revitalize the global partnership for sustainable development." In order to achieve the targets of the 2030 Agenda for sustainable development, the global partnership and collaboration with governments, businesses, and the civil society are very crucial to mobilize the resources of the private sectors, to set a clear direction of the public sectors, and to enhance the power of international institutions (The United Nations 2017a).

The United Nations established Framework Convention on Climate Change which is known as the Paris Agreement. This agreement brings all the nations into a common goal to solve the climate change issues. This agreement was signed by the nations on 22 April 2016 in New York and enforced on 4 November 2016, and almost 86% of parties have ratified to the Convention (The United Nations 2017c). The objective of the Paris Agreement is to strengthen the global partnership and collaboration to avoid a global temperature rise up to 2 °C in order to remain a low greenhouse gas emission (The United Nations 2017c). Thus, developed countries have the obligations to provide sufficient financial resources and new technologies so as to build the potential capacity (The United Nations 2017c). This agreement requires all the parties to set "nationally determined contributions" (NDCs), and these parties report on their carbon emission level and their progress. The United Nations will access their greenhouse gas contributions for every 5 years.

Importantly, the role of MNCs in most developed countries plays a significant contribution in sustainable development (Unerman et al. 2007). Most MNCs tend to incorporate and integrate Elkington's (1997) triple bottom line framework, including economic development, social equality, and environmental protection, into their business operation. Critical scholars contend that most of organizations tend to use the concept of sustainability as a part of business strategies in order to achieve the win-win or the triple wins scenario. Other organizations simply adopt sustainability as a public relation tactic to obtain approval from powerful stakeholders and gain societal support in the business context (Unerman et al. 2007).

Major Bodies Promote Accountability and Sustainable Reporting

There are five major parties which extensively promote accountability and sustainable reporting, namely, the World Business Council for Sustainable Development (WBCSD), the International Organization for Standardization (ISO), the Global Reporting Initiative (GRI), AccountAbility, and the Global Compact (see Table 1). The following sections provide a general overview of the common accountability frameworks.

First, the World Business Council for Sustainable Development (WBCSD) was formed with the World Industry Council for the Environment and Business Council for Sustainable Development in 1995. The WBCSD consists of around 200 multinational companies (MNCs) from over 60 countries. The Council identified the following categories for sustainable development in 2004: accountability and corporate reporting, advocacy

Accountability and Sustainable Development, Table 1 The various reporting guidelines

Organization	Year	Reporting requirement
The World Business Council for Sustainable Development (WBCSD)	1995	Voluntary
International Organization for Standardization (ISO)	1996	Voluntary
The Global Reporting Initiative (GRI)	1997	Voluntary
AccountAbility	1999	Voluntary
The Global Compact	2000	Voluntary

Source: Adams and Narayanan (2007): 81

and communication, competence building, climate change, and energy saving and sustainable healthcare systems (Adams and Narayan 2007). The Council integrated the 17 SDGs and around 170 targets, which showed the new ambition to achieve the 2030 agenda as suggested by the United Nations in 2015, into their main four major missions: (1) energy, (2) food and land use, (3) cities and mobility, and (4) redefining value (WBCSD 2017). In particular, the fourth mission is redefining value which all companies adopt an integrated approach to disclose account not only for financial capital but also for non-financial capital (i.e., social and natural capital) valuation, measurement, and disclosure (WBCSD 2017). The Council will assist their members to prepare and produce such reporting so as to achieve the 2030 agenda for SDGs.

Second, International Organization for Standardization (ISO) is an independent and non-governmental organization that covers over 160 national standard bodies of around 150 countries (ISO 2017a). ISO brings professionals to exchange ideas and share practical knowledge in order to develop voluntary policies and procedural standards that provide guidance on what type of information to disclose and how to report for organizations (Adams and Narayan 2007). The ISO standards could be used to encourage organizations to report their sustainability performance and impact of their business operation (Adams and Narayan 2007). There are three main standards in relation to accountability and sustainable reporting practices, namely, ISO 14000, ISO 26000, and ISO 50001.

In 1996, the ISO established ISO 14000 environmental management system that provides a series of standards that cover environmental management and helps organizations to improve their environmental performance in a number of areas: waste reduction, energy efficiency, resource allocation, competitive advantage, and stakeholder management (see ISO 2017b).

- ISO 14001, ISO 14004, and ISO 14006: Environmental management system
- ISO 14040 and ISO 14043: Environmental management – life cycle assessment
- ISO 14010, ISO 14011, and ISO 14012: Environmental auditing
- ISO 14032: Environmental performance evaluation
- ISO 14064 -1: Quantification and reporting of greenhouse gas (GHG) emissions

ISO 26000: 2010 – Guidance on social responsibility assists organizations to follow certain frameworks and guidelines to manage their operation in a socially responsible way in order to achieve sustainable development (ISO 2017c). This guideline is designed for all types of organization in different sizes and locations, provides clear definition of key terms, and helps companies to understand the linkage and association between social responsibility and SDGs (ISO 2014). There are core seven principles of social responsibility: accountability, transparency, ethical behavior, human rights, stakeholder interest, respect for the law, and follow international norms of behavior (ISO 2014). ISO 26000 is linked to international norms and common practices, namely, the GRI guideline, the UN Global Compact, International Labour Organization, the United Nations Sustainable Development Goals, The OECD Guidelines, and the United Nations working on the issues of business and human rights (ISO 2017c).

ISO 50001: 2011 energy management system assists organizations to incorporate energy management into their business operation in order to enhance the overall quality on environmental management. This guideline includes installing new energy-efficient technologies, minimizing energy waste, or reducing energy costs. The ISO 50001 (2016: 6–8) offers a series of standards and related guidelines on energy savings and management portfolio:

- ISO 50002: Energy audits
- ISO 50003, ISO 50004, and ISO 50006: Energy management systems
- ISO 50045: Energy saving evaluation
- ISO 50046: General quantification methods for expected energy savings
- ISO 50049: Calculation methods for energy efficiency and consumption variations at different levels (city, regional, and country)

Third, the Global Reporting Initiative (GRI) (the Guidelines) was established by the Coalition for Environmentally Responsible Economies (CERES) with the assistance of the UN Environment Programme (UNEP) in 1997 (Crane and Matten 2016). The Guideline provides an international guideline for organizations to disclose not only the economic performance but also social and environmental performance and impacts of organizations voluntarily (Global Reporting Initiative 2015). The Guidelines are a multi-stakeholder approach that includes financial experts, professionals, auditors, labor unions, and civil society (Global Reporting Initiative 2015). The Guidelines for reporting sustainability and related issues are primarily based on reporting major principles of accuracy, auditability, completeness, comparability, neutrality, relevance, transparency, and timeliness (Adams and Narayan 2007). The standard disclosure of a sustainability report covers seven main areas: (i) corporate strategy, (ii) corporate profile, (iii) identification of material aspects and limitations, (iv) stakeholder engagement, (v) corporate disclosure profile, (vi) corporate governance, and (vii) ethics and integrity (Global Reporting Initiative 2015). The Guidelines involve three main disclosure categories: economic, social, and environmental dimensions. In particular, social categories are generally subdivided into four aspects that include human rights, employee working practices, impacts on society, and product responsibility (Global Reporting Initiative 2015). Environmental dimensions cover a number of major aspects, such as energy, emission, water, waste, environmental compliance and assessment. Some of these categories are closely linked to the OECD Guidelines for Multinational Enterprises and the UN Global Compact (Global Reporting Initiative 2015). Over 70% of the global companies have adopted the GRI guidelines in 2015 (Global Reporting Initiative 2015).

Fourth, the Institute of Social and Ethical Accountability (AA1000) standard was established by AccountAbility that provides a clear standard and guideline on ethical and social accountability and reporting practice in the UK in 1999 (Adams and Narayan 2007). The AA1000 framework was designed with two major objectives: (1) to act as a separate framework to manage accountability and other relevant issues and (2) to integrate other sustainable development frameworks, such as Social Accountability International (SA 8000) standards, the ISO standards, and the Global Reporting Initiatives (GRI) (Adams and Narayan 2007). The AA1000 framework has been strongly affected by traditional financial accounting principle and accountability principle. In particular, an organization should integrate not only the principle of standard financial accounting but also the principle of accountability into its ethical and social accounting, auditing, and disclosure practices to business operation (Adams and Narayan 2007). The term "accountability" is referred to transparency, responsibility, and compliance with legal framework (Adams and Narayan 2007). Apart from accountability, inclusivity is another important principle that includes three main areas: (i) completeness, materiality, and timeliness; (ii) assurance, accessibility, and information quality; and (iii) continuous improvement (Adams and Narayan 2007).

Fifth, the Global Compact is initiated by the United Nations Environment Programme (UNEP) at New York Headquarters in 2000 and provides general guidance for organizations to address sustainability issues on voluntary basis. The Ten Principles of the UN Global Compact mainly include four main dimensions: human rights, labor, environment, and anti-corruption. These principles and initiatives are often derived from the global institutions, such as the Universal Declaration of Human Rights, the International Labour Organization, and the United Nations Convention Against Corruption (The United Nations Global Compact 2014). Over 8000 companies, mostly small medium enterprises (SME) from European countries and 4000 nonbusinesses, for example, NGOs, business associations, and academics, participated in the Global Compact (The United Nations Global Compact 2014). This requires both business and nonbusiness members to offer a platform for an annual Communication on Progress (COP) that reports how these participants incorporate the Ten

Principles into their strategies, operations, and management systems (The United Nations Global Compact 2014).

The Overall Sustainable Reporting Performance of MNCs

The development of sustainability reports has gradually received attention over the past two decades. International companies tend to disclose their sustainability information in terms of economic, social, and environmental performance. A simple model of accountability (Fig. 1) illustrates the relationship between an accountee (the principal) and an accountor (the agent) (Gray et al. 2014). This model could apply to an organization that seeks to pursuit sustainability. This model represents the relationship between the principal (shareholders) and the agents (directors of a company). Shareholders tend to give certain instructions or particular expectations on how to achieve sustainability, such as community involvement, green investment, or environmental engagement, to directors of a corporation. If directors meet these targets set by shareholders, directors will receive monetary reward for achieving these targets. Therefore, directors of a corporation are expected to be accountable to shareholders for the extent to which the organization is working on economic, social, and environmental performance about sustainability. Thus, the members of the community may wish to hold the organization to account for its economic, social, and environmental performance (both favorable and unfavorable news) for record (Gray et al. 2014). Global 250 companies, such as Walmart, Royal Dutch Shell, and Apple, tend to produce different accounts on economic, social, and environmental information on sustainability reporting to external stakeholders. These companies tend to adopt the major reporting guidelines from five main bodies that promote accountability and sustainable reporting as discussed above (see Table 1).

However, such information on sustainability reporting appears to be inconsistent, incomplete, and unverified (Crane and Matten 2016). Measurements of sustainability reporting practices vary across industry, country, and jurisdiction. Klynveld Peat Marwick Goerdeler (KPMG), one of the four international accounting firms, has provided a continuous and systematic assessment on these voluntary sustainability reports of national and global companies since 1997 (Gray and Herremans 2012). Approximately 92% of the global 250 companies and around 75% of national 100 companies disclose sustainability and related issues in their annual reports and standalone sustainability reports (KPMG 2015). The main driver of such reporting practices continues to be mandatory rather than voluntary, since local governments require companies to disclose nonfinancial information (KPMG 2015; Leung 2015). Currently, the reporting rate of the traditionally and environmentally sensitive industries, namely, mining, utilities, and oil and gas, is nearly 80%, as these companies tend to report more environmental and social information on sustainability reports (KPMG 2015). However, the global reporting rate of some environmentally sensitive industries, such as transports and leisure, manufacturing and metals, and retail, is still below 65% in 2015 (KPMG 2015).

The original aim of elevating sustainability reporting is to make it as creditable as financial reporting in terms of comparability, verifiability, and rigor (Crane and Matten 2016: 188). However, different companies in different industries intend to report on different types of information on sustainability reports. Thus, the latest G4 version of the GRI guideline emphasizes on materiality that companies could identify issues that are relevant for their business operations and important stakeholders (Crane and Matten 2016). Importantly, KPMG employs seven criteria to assess the quality of sustainability reporting: corporate strategy, risk management, materiality, key performance indicators, supply chain management, corporate governance, stakeholder engagement, and transparency (KPMG 2015). The KPMG's report indicates that there has not been an overall improvement in the quality of sustainability reporting among the global 250 companies. Companies tend to disclose positive information rather than negative information in order to distract from stakeholders' attention (Leung and Gray 2016; Leung and Snell 2017; Noronha et al. 2015). More pertinently, the third-

party assurance of sustainability reporting is a standard practice for multinational companies. External assurance could show to stakeholders with confidence in the quality of sustainability information and enhance internal improvement (KPMG 2015). Approximately 65% of the global 250 companies have their sustainability information independently assured by the third party, such as major accountancy organizations (KPMG 2015). Half of the companies tended to choose to seek external assurance for the whole sustainability report, while one third selected to have particular performance indicators assured (KPMG 2015). Large companies in France, South Korea, and Greece tend to seek independent assurance of sustainability information.

Final Remarks

Accountability of organizations toward sustainable development is expected to be growing significant concern as the world strives to improve sustainability performance. These organizations should include profit, nonprofit, and other governmental organizations that are supported by public funding. Accountability of multinationals that continue to expand across borders seeking market opportunities and possessing tremendous economics should be considered exceptionally for their potential impacts on sustainable development. Such weighted accountability could provide better check and balance against the hegemonic claims of businesses about their sustainable development (Gray 2010).

Cross-References

- ▶ Accountability and Sustainable Development
- ▶ Sustainable Development Goals

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Accreditation Schemes and Sustainable Development in Management Education

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Accreditation

Although accreditations are not the only factor that determines what business schools believe, do, and become, it certainly is an important shaper of the direction in which they find their way forward in the face of the twenty-first-century management education imperatives (Harvey 2004; Hedmo et al. 2001; Prøitz et al. 2004; Lindstrom and Word 2007). Because of their relevance and impact in management education, this entry focuses on international business accreditations EQUIS and AACSB.

Introduction

The cross-border reputation of higher education institutions is established through a two-stage filtering system, with international accreditations providing access while acting as "certifiers" and international rankings defining the relative competitive position. The interrelations between accreditation and higher education become especially evident in the field of business and management education. A variety of mandatory accreditations (national) as well as voluntary assessment schemes (international) have emerged and challenge business schools while driving substantially their institutional strategies. In order to better illustrate the role of accreditations in the sustainable development in higher education, this entry focuses on the group of business and management schools and their responses to accreditation standards and criteria. Business schools are not much different from other institutions in the higher education industry, and much can be learned from the management education sector and applied in universities (Petriglieri 2015).

Although accreditation is not the only factor that determines what business schools believe, do, and become, it is certainly an important shaper of the direction of travel in the face of the twenty-first-century management education imperatives. This has especially become the case since the integration of a strong ethics, responsibility, and sustainability narrative (Maclean et al. 2015) in the prestigious European Quality Improvement System (EFMD) accreditation, as well as for business schools' eligibility to Association to Advance Collegiate Schools of Business (AACSB) accreditation. Until today, a comprehensive and constructive dialogue in business schools, as well as within the wider community, seems to be missing (Powell et al. 2016). Therefore, the role of accreditations such as EQUIS is of particular importance as they drive business school developments. While EQUIS in the past had focused on internationalization and corporate relations, the accreditation body added a third transversal standard "ethics, responsibility, and sustainability" in 2013 (EFMD 2016).

Context

The management education sector is perceived as slow adaptors to the responsibility and sustainability agenda. Despite some visible activities, there is evidence that responsible management education remains largely as an "unfulfilled promise" (Cornuel and Hommel 2015). Recent literature and research have been critical about business schools' integration of ethics, responsibility, and sustainability into their teaching and research activities, and the majority of institutions are continuously challenged by internal resistance and resource constraints (Aspling 2013; Ghoshal 2005; Alvesson 2013; Muff et al. 2013; Cornuel et al. 2015). It is therefore widely argued that business schools continue to deliver a narrow view on responsible management education, while many of their primary stakeholders, such as students, governments, and companies, demand a greater sense of purpose (De Onzono 2011). Within this context, national and international business school accreditations play a dual role in the development of a more responsible and sustainable management education. While accreditation bodies arguably had its share in business schools' narrow-minded approach to research and education in the past, it also plays an important role by driving processes and acting as a change agent in business schools' development (Canals 2010).

Transnational Accreditations

Business school accreditation has its roots in the United States (Khurana et al. 2005). Since the early twentieth century, accreditation has been the main monitoring regulator of North American business and management schools, with predefined quality standards in various academic areas and being administered by independent, nongovernmental organizations (Locke 1989; Porter and Mckibbin 1988). The most important and oldest American accreditation body is the Association for the Advancement of Collegiate Schools of Business (AACSB), which has been accrediting business schools for over 100 years.

The rise of accreditations and assessments during the 1980s can be seen as part of a larger societal trend. In a world that is increasingly characterized by variations and differences, accreditations are one way to bridge those differences and facilitate the flow of information (Thomas and Cornuel 2012). Additionally, assessment criteria and audits are considered as a reaction to the evolving risk society (Hood 2004), with its increasing demand for transparency and accountability, which appear in parallel with increasing access to higher education through globalization and mobility (Power 1999). Moreover, the emergence of new regulations has been further analyzed as an aspect of rationalization in higher education that is increasingly challenged by growing competition and deregulation (Moran 2002). Other scholars suggest that the growing importance of accreditations could rather be described as a fashion in the search for additional certifications, standardization, and quality assurance systems, all in order to achieve differentiation in competitive, globalized markets (Meyer 1994; Hood et al. 1999; Engwall and Morgan 2002). However, the pressure in higher education – resulting from internationalization as well as the intensification of transnational competition – led to an "explosion" of regulations that is challenging national accreditation systems (Djelic and Sahlin-Andersson 2006).

Picking up on demands for more transparency as well as comparability and market information, accreditations have been developed as a response to market pressure that is coming not only from consumer groups but also from competitive forces in the business school accreditation market (Hedmo et al. 2001; Beehler and Luethge 2013). In this context, New Public Management (NPM) has created the environment and the imperatives for business school accreditation.

Management literature and research has widely discussed how accreditation bodies can ensure an impact on business schools' quality, while balancing their mission between membership interests and the enhancement of (accreditation) standards (Rasche and Gilbert 2015; Starkey and Tiratsoo 2007; Vas and

Lejeune 2004). Understanding how accreditation bodies and schools interrelate and affect each other is key when it comes to explaining how accreditation standards have been developed. The reciprocal relations explain the interwoven processes and expansion of regulations, framed by voluntary agreements between regulators and regulatees (Moran 2002). In this context, it is important to recognize the multilevel governance concept of accreditation organizations, which captures the interrelatedness of regulatory actors and those that are regulated (Majone 2002). Following Bourdieu's notion of the organizational field, it can be said that there is a common belief in the importance of management education by various actors (Locke 1989; Porter and Mckibbin 1988); however, at the same time, those actors disagree on how to define, assess, and develop the activities (Bourdieu and Nice 1980). It is necessary to point out the complexity of interrelations, political struggles, and collaborations when explaining the correlation between different actors in management education (De Onzono 2011; Majone 2002). The intertwined management education providers, accreditations, and monitoring bodies develop in relation to each other, and, as a result, the entire field has become a "regulatory knot" (Hedmo et al. 2001).

Accreditations and Responsible Management Education

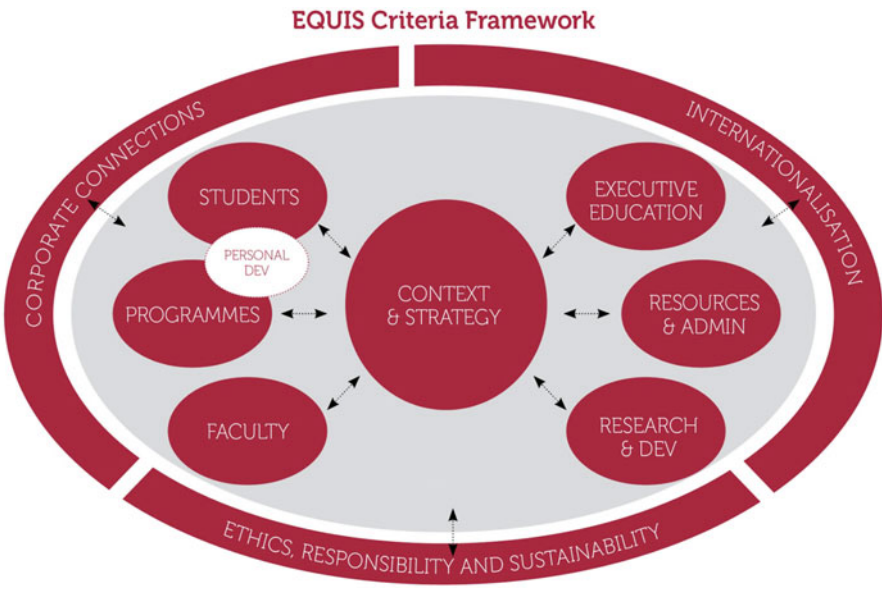
Accreditations act as an interface between the higher education sector and industry, companies, and public organizations. From this vantage point, accreditation is required to translate expectations from the public and private sectors into its accreditation standards, which apply to ethics, responsibility, and sustainability (ERS) as much as to all other important aspects of education (Naidoo and Pringle 2014). Having a diverse and large group of international members provides accreditations with a unique position and access to different key players. The organization should link these "partners" in a joint effort to develop and fully integrate ERS in management education. Through strengthened commitment to ERS, accreditations would identify those institutions that deliver high quality in ERS/RME in different geographic areas, which would signal the importance of these topics within the business school sector and provide immediate benchmarking opportunities.

In 2012, following the global economic crisis and the resulting stakeholder pressure (Rasche and Gilbert 2015; Thomas et al. 2014), accreditation bodies such as EQUIS revised their standards and criteria in 2013 and established far-reaching requirements to integrate ethics, responsibility, and sustainability (ERS) transversally into all major areas of business and management education (Thomas et al. 2013) (see Fig. 1). The changes imply that responsible and ethical behavior should be an integral part of a business school's values as well as strategy and should be reflected in all of its regular activities. The transversal accreditation standards also established definitions for ethics, responsibility, and sustainability applicable for the management education sector.

But also AACSB introduced new criteria for responsible management education in their 2013 revised Business School Accreditation Standards (AACSB 2015). By linking responsibility and sustainability to the initial eligibility phase, AACSB expects substantial developments to be in place prior to a school entering the accreditation process. One of the guiding principles is that "The school must encourage and support ethical behavior by students, faculty, and professional staff" (AACSB 2011, 2015). A strong commitment to corporate and social responsibility is demanded, and "The school must demonstrate a commitment to address, engage, and respond to current and emerging corporate social responsibility issues (e.g., diversity, sustainable development, environmental sustainability, globalisation of economic activity across cultures) through its policies, procedures, curricula, research, and/or outreach activities" (AACSB 2015).

Sustainable Development in Management Education

Debates around the importance of responsible management education arrived in the epicenter



Accreditation Schemes and Sustainable Development in Management Education, Fig. 1 EQUIS Criteria Framework (EFMD 2016)

of business schools only following the eruption of the economic crisis in 2007 (Muff et al. 2013; Starkey et al. 2004). Business schools began to understand that continued demand for management education and market growth is not in itself an adequate indicator of the value and success of management education (Thomas et al. 2014). Many different approaches have encouraged reconnecting management education with business and society. Buzzwords such as corporate social responsibility, corporate citizenship, business ethics, social entrepreneurship, corporate sustainability, and conscious capitalism are widely used and common in the marketing and communication plans of business schools (Holland 2009; Cornuel and Hommel 2015; Gosling 2003; Mintzberg 2004; Naidoo and Pringle 2014). However, besides the many commitments and discussions, Dyllick (2015) argues that most business and management schools continue to teach biased content in business functions, often ignoring the fact that these functions have negative effects on the sustainability performance of companies (Bondy and Starkey 2014). Many management education institutions also dismiss public interest in favor of private interests (Muff 2013). In this context, the definition and understanding of responsible management education depends largely on cultural background and values. Therefore, it is not surprising that concepts of ethics, responsibility, and sustainability are interpreted differently throughout the management education world (Nohria and Khurana 2010), which created a challenge to accreditations that needed to assess the school's performance also in this sector.

While on one hand accreditations provide guidance and pressure business schools to integrate ERS in their strategies, governance, research, curricula, and extracurricular activities (Rasche and Gilbert 2015), on the other hand, the rising importance of responsible management education and learning (RMLE) has led to intra-institutional tensions as well as created resistance toward the development of a more responsible management education (Cornuel and Hommel 2015). Scholars such as Muff (2013) and Thomas et al. (2013) argue that the strong relationship between regulatory agencies and regulatees may even limit accreditations to be the visionary leader in business schools' change processes.

The Way Forward

In response to the global economic crisis, European management education received coercive, mimetic, and normative pressures from both internal and external stakeholders, which forced business schools to adapt and implement further elements of responsible management education. Coercive pressure is channelled through national and international accreditations and other certifications and is immediately linked to a school's reputation and resource dependencies. In particular, public business schools were forced to adapt to external regulations in order to maintain or increase funding (Powell and Dimaggio 2012; Campbell and Pedersen 2001). International business school accreditation agencies are considered as one of the important sources of coercive pressures for responsible management education (Rasche and Gilbert 2015). Although the accreditation standards give room for interpretation, business schools cannot ignore their call for responsible management education (Scharmer 2009), as accreditations act as an important source of legitimacy (McKiernan and Wilson (2014).

According to Wilson and McKiernan (2011), one or a combination of coercive, mimetic, and normative pressures has led to some of the current aspiring or accredited schools to address demands for responsible management education by creating only isomorphic changes. Through this, business schools may signal their "belonging to the club of EQUIS-accredited schools" by sharing social values and gaining legitimacy in the eyes of internal and external stakeholders and society at large through isomorphic behavior such as decoupling (Kraatz and Zajac 1996; Campbell and Pedersen 2001). Those schools risk further damage to their reputations and to lose their legitimacy (Powell et al. 2016).

There is much to learn from business schools and the recent accreditation developments alike. Future debates on responsible management education will be informed through sights from research, which help the entire higher education sector as well as accreditations to further guide their ERS/RME developments. Forces in favor and against are in play, and accreditations can in this regard count on strong support from a number of business schools committed to responsible management education (Waddock et al. 2010; Rasche and Gilbert 2015; Forray and Leigh 2012). It is therefore important to keep the quality assurance denoted by accreditation in balance with the invitation for more schools to belong, participate, and create value that aligns with the sustainable development imperatives of our times (Zammuto 2008; Solomon et al. 2017; Beehler and Luethge 2013). But what are the implications for accreditations and the wider business school community?

While empirical studies support business schools in their self-assessment and in outlining future strategies related to a more responsible management education, studies also indicate a need for stronger cooperation between business schools that allows benchmarking and jointly developed ERS actions (Rasche et al. 2013; Maclean et al. 2015). However, also the accreditation bodies need to further assist business schools in their RMLE developments. Business school accreditations play an important role as they set the tone, define priorities, and guide changes in management education (Hedmo et al. 2001). With its unique positioning as an international regulatory and member organization, accreditations can directly influence the strategic directions of business schools. With its mandate and role in society, accreditations should foster a sense of global responsibility in business schools and thus contribute substantially to the well-being of societies around the globe (Naidoo et al. 2011).

As the EQUIS accreditation standards established strong references to ERS, they also need to provide guidance to business schools in the development of responsible management education. Equally to its focus on high-quality developments in internationalization and corporate connections, EQUIS must give ERS the same degree of importance. Accreditations and business schools should define jointly how to measure quality in ERS and distinguish between schools that "walk their ERS talk" from those that decouple their RME commitment from actions and only engage in isomorphic changes (Bromley and

Powell 2012). Consequently, business schools that go through the accreditation process will need to provide clear evidence of their ERS developments. In addition, accreditations would provide support to fill the "know-how gap" by informing schools on how to measure ERS quality and providing benchmarks and better practice models. In cooperation with other organizations and business schools, accreditations should provide learning platforms where institutions can exchange RME experiences and practice.

Therefore, accreditations should be more rigorous in the assessment of ERS actions and help schools to shift their attention from "ERS talk" to "ERS action." If accreditations and business schools do not work together to define quality indicators and monitor ERS performance and impact, the standards will remain subject to individual interpretation. Without this critical step, the process may not lead to the change necessary to respond to modern economic, social, and environmental challenges. In summary, if accreditation organizations do not respond to the criticism from business schools, they also risk being considered as "not walking their own talk" by decoupling accreditation standards from the assessment and regulatory activity (Rasche and Gilbert 2015).

With support from EFMD and other important organizations in the field, business schools may advance further toward responsible management education. Business schools can change further and become more ethical, responsible, and sustainable, but in order to do so, business schools together with accreditations, rankings, and other regulating agents need to cooperate to further develop the current RMLE agenda (Starkey and Madan 2001; Skapinker 2011). A stronger sense of accountability will help the responsible management education sector evaluate those activities and measure the real impact and advantage they provide for the society at large (Powell et al. 2016). This will require business schools and accreditations to further reinvent themselves and find a common purpose for their existence, which includes a radical rethinking of management education paradigms (Naidoo et al. 2014). Business schools are at a "tipping point" where they must reconnect with their primary responsibilities by serving the needs of their societies (Thomas et al. 2013; Hommel et al. 2016). In transforming to more responsible management education, the schools will have to approach a number of institutional changes that will eventually lead to more ethical, responsible, and sustainable management education. Therefore, management education will have to embrace disruptive change as opposed to the incremental change we have largely seen in the past. The schools, with support from the accreditations, may review the research practice to improve the relevance and impact of their academic as well as applied research. Equally important, business schools must continue changing their curricula, which will require advanced teaching skills in critical and integrative thinking to help students to become management innovators. By changing their own paradigms, business schools will be able to change toward more responsible management education, and by doing so, they can become the interface between the higher education sector and the society that demands this change.

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Action Inquiry

▶ Reflective Practice for Sustainable Development
▶ Service-Learning and Sustainability Education
▶ Work-Integrated Learning for Sustainability Education

Action Learning

▶ Reflective Practice for Sustainable Development
▶ Service-Learning and Sustainability Education
▶ Work-Integrated Learning for Sustainability Education

Action Research

▶ Reflective Practice for Sustainable Development
▶ Service-Learning and Sustainability Education
▶ Work-Integrated Learning for Sustainability Education

Action Research on Sustainable Development

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Definition

Action research (AR) can be defined as a systematic type of research enabling "people to find effective solutions to problems they confront in their everyday lives" (Stringer 2013). Based on a reflective process on a cycle of actions, a particular problematic situation can be addressed. The idea behind is that by doing so

changes occur within the setting, the participants, as well as the researcher (Herr and Anderson 2005).

Introduction

Since the rise of the international discussion starting with the publication of the Brundtland report "Our common future" in 1987 (WCED 1987), many approaches and programs have been initiated toward a sustainable development. "Sustainable development is a process with the clear vision to change our societies from unsustainable to sustainable" (Baumgartner 2011). Nonetheless, many sustainability-related problems are still existent or even faced by increasing negative impacts. This leads to the assumption of a lacking awareness, ability, and/or willingness to adopt the necessary change. In this context, Wilber (2000) provides an analysis of factors that limit change: (1) individual subjective factors (values, worldview, etc.), (2) individual objective factors (sociodemographics, knowledge, etc.), (3) collective subjective factors (culture, shared norms, etc.), and (4) collective objective factors (political, economic, technological, etc.). Given the necessity of change by overcoming these barriers, Ballard (2005) identifies three conditions that are required in responding to the challenge of sustainable development: (a) awareness of what happens and what is required; (b) agency, which means responding in a subjective meaningful way; and (c) association or collaboration with others. To implement change it is necessary to work across all of these conditions, whereby this requires the key process of (d) action and reflection. In the light of permanent learning needs for sustainable development, action and reflection processes are seen as central factors.

Sustainable development can be seen as a complex, dynamic process of further development and learning toward better solutions for existing challenges, whereby the creation of awareness for sustainability leads over a deep individual and organizational change (Tschiggerl and Fresner 2008). As change concepts can be manifold, Egmose (2015) considers sustainable change as equally radical and democratic, which means that unsustainable current ways of living have to be transformed by "democratic experiments" that transcend present realities. Baumgartner and Korhonen (2010) state that there is an urgent need for taking actions for sustainable development. In this context science is required to help society to identify and solve sustainability problems using adequate research approaches.

Considering these limitations and aspects to implement actions for sustainable development, this entry presents action research as a viable method toward solving sustainability-related issues. Therefore, it is important to understand the methodological basics of action research (AR), which will be presented and discussed regarding potential difficulties and critics. Especially the AR process will be explained in detail to retrace how change can be achieved. Following, several examples of action research applied to sustainability-related issues will be presented to recognize the usefulness of this type of investigation. The last chapter concludes why action research can help to foster and implement real change toward sustainable development.

Action Research as a Collaborative Approach Towards Sustainable Development

As stated by several authors (Ballard 2005; Reason and Bradbury 2006; Park 2006; Zuber-Skerrit 2012; Egmose 2015), the action research methodology offers a useful approach for understanding and working with complex socio-ecological systems to encourage collaborations and participation aiming at intervention, development, and change (Manring 2014). Therefore, traditional research and development strategies have to be supplemented by human initiatives, innovations, and actions resulting from participative and democratic processes that allow new knowledge creation to solve problems (Zuber-Skerrit 2012).

Zuber-Skerrit et al. (2013) describe the democratic values of collaboration and

participation as the essential objectives for action research. Therefore they propose a framework of participatory action learning and action research (Fig. 1) to explore possible ways to reach a transformation toward sustainable development.

According to the authors, democratic values can lead to wisdom, which can be seen as a social construct of deep understanding of relationships and the ability to identify the most meaningful action to solve problems and challenges. To achieve a reformation and transformation of current (-unsustainable) practices, it requires the extension of wisdom to creativity and innovation. This can be generated by transformed – in the sense of aware – individuals or groups participating in action research processes (Zuber-Skerrit et al. 2013).

The following chapter describes the methodological aspects of action research and gives an overview of characteristics, the research process, and criteria to assess the quality of AR studies.

The Methodology of Action Research

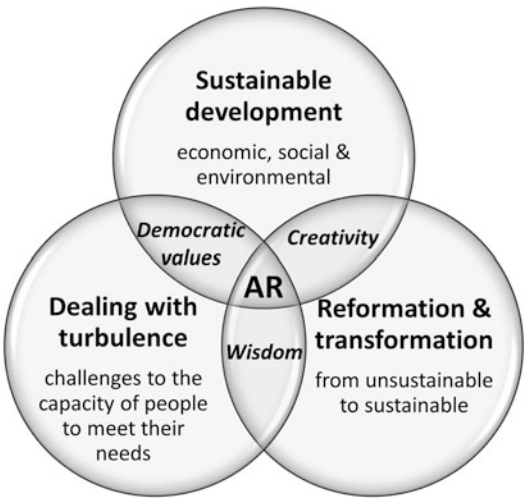
Action research is a research approach that aims at the execution of an action and the generation of knowledge and a theory about it while the activity evolutes. The results are as well action and research outcome, whereas the objective of traditional approaches is solely the creation of knowledge (Coghlan and Brannick 2014). Action research can be explained as a cyclical process of diagnosis, action planning, action taking, evaluation, and specified learning. The focus is rather on active research than on research about action, where the members of the system being investigated are actively participating in the process (Middel et al. 2005). Greenwood (2007) describes the approach as follows:

> Action research is neither a method nor a technique; it is an approach to living the world that includes the creation of areas for collaborative learning and the design, enactment and evaluation of liberating actions . . . it combines action and research, reflection and action in an ongoing cycle of cogenerative knowledge.

The origins and the basic idea can be traced back to the psychologist Kurt Lewin. He proposed a participative action research paradigm where the attendees not only generate but also apply knowledge during the research process. Thus, AR can be seen as a democratic process (Skinner 2017).

To classify research as action research, the following five elements should be contained (Meyers 2013):

1. Aim and benefit: While scientific investigations aim at the expansion of general knowledge, AR targets the knowledge acquisition and solution of a practical problem. The focus is on transformation and change toward a positive value for the society.
2. Contextual focus: As the action researcher deals with real-life problems, the context has to be broader than in case study research.
3. Data relying on change and construction of knowledge: AR is change oriented; thus, it requires data that detect the consequences of an intended change. Action researchers need therefore continual and systematic collected data, which further require an interpretation to generate knowledge from it.
4. Participative research process: AR demands the active participation of those affected by the real-life problem and who "own" it. As AR is collaborative, the concerned should at least be involved in selecting the problem, identifying solutions, and validating results.



Action Research on Sustainable Development, Fig. 1 Action research for sustainable development. (Source: Adapted from Zuber-Skerrit et al. 2013)

5. Knowledge dissemination: AR has to be documented and disseminated according to accepted scientific practices to be considered as research. This means that a research topic has to deal with existing literature to generate general knowledge. This falls to the action researcher.

Types of Action Research

Zuber-Skerrit and Perry (2002) as well as Skinner (2017) distinguish between three types of AR: Type 1 requires an external expert as support due to the complexity of a problem. Type 2 can involve a facilitator, but the focus is on individual power of equal participants. In type 3 the power is completely within the group. Table 1 gives an overview of AR types and their main characteristics.

The system boarders between formal (technical) and practical action research are stringent; only emancipatory AR uses all technical and organizational competences. Thus, this type relates most to organizational learning (Zuber-Skerrit and Perry 2002). According to Carr and Kemmis (1986), only type 3 can be marked as real AR as it fulfills the minimum requirements: strategic action determines the content; the proceeding includes planning, action, observation, and reflection; all phases of research activities integrate participation and collaboration.

Independent from the type of AR, three basic topics are handled in every definition and classification: empowerment of participants, adoption of knowledge, and social change (Masters 1995). However, contemporary action research is affected by a great variety (Meyers 2013).

The Action Research Process

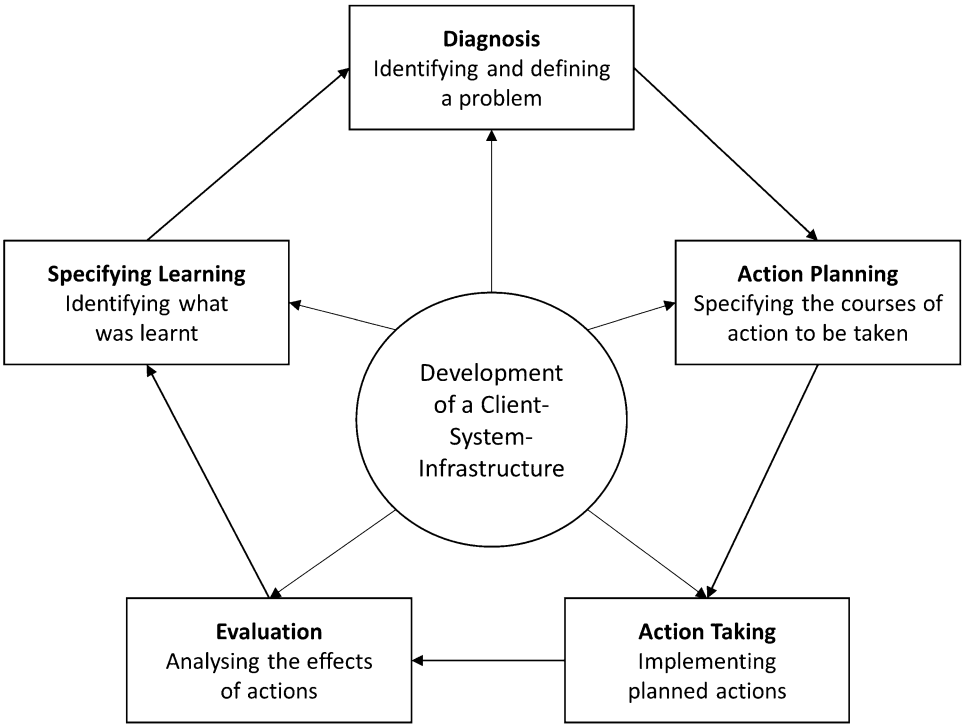
In its simplest form after Lewin (1997 [1946]), the AR process contains a pre-step and three core activities: planning, action, and detection of facts. The objective is defined in the pre-step. Planning includes in general that there is a plan and the decision regarding the first step. Acting means to conduct the first step, and detection of facts deals with the evaluation of what was learnt. This builds the basis for the next step and an ongoing spiral of planning – acting – evaluating.

Susman and Evered (1978) describe AR as cyclical process with five steps: diagnosis, action planning, implementing action, evaluation, and definition of learnings (Fig. 2). The infrastructure within a client system, which can be described as the research context, and the action researcher facilitate and regulate some or all phases together.

Coghlan and Brannick (2014) propose an AR cycle consisting of a pre-step (context and aim) and four basic steps: design, action planning, action taking, and evaluation. The emphasis is

Action Research on Sustainable Development, Table 1 Action research types and their main characteristics. (Source: Zuber-Skerrit and Perry (2002))

AR type	Objectives	Facilitator's role	Relationship between facilitator and participants
Type 1 "technical"	Effectiveness/efficiency of professional practice Professional development	Outside "expert"	Co-option (of practitioners who depend on the facilitator)
Type 2 "practical"	As type 1 Practitioner's understanding Transformation of their consciousness	Socratic role, encouraging participation, and self-reflection	Cooperation (process consultancy)
Type 3 "emancipatory"	As type 2 Participants' emancipation from the dictates of tradition, self-deception, coercion Their critique of bureaucratic systematization Transformation of the organization and of its system	Process moderator (responsibility shared equally by participants)	Collaboration (symmetrical communication)



Action Research on Sustainable Development, Fig. 2 Cyclical process of action research. (Source: Susman and Evered 1978)

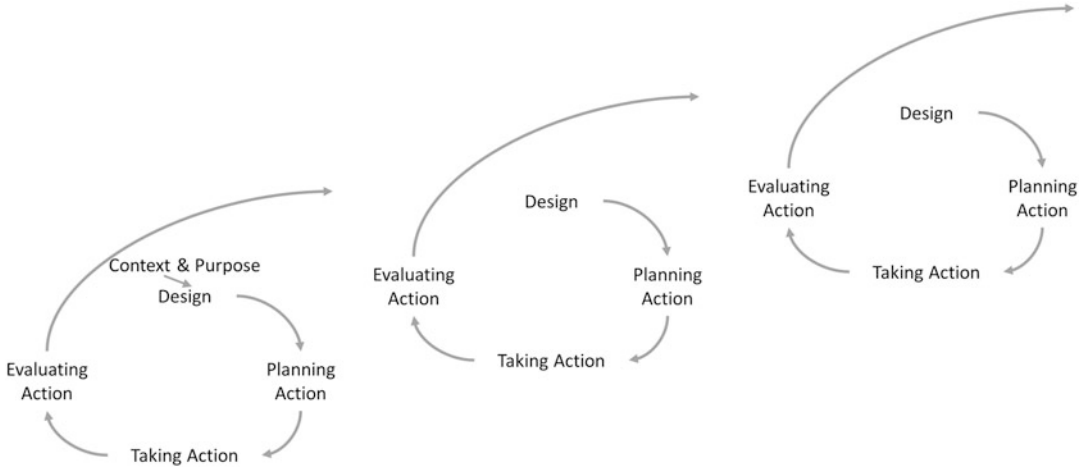
on the first step regarding the design where stakeholders construct the problem and relevant questions in the form of a dialogue. They have to be articulated carefully as they are as well practical and theoretical foundation for the actions. After planning and taking those actions, the results should be evaluated regarding the following questions:

- Was the initial design adequate?
- Did the conducted actions correspond to the design?
- Were the actions conducted adequately?
- What will be implemented within the next cycle of design, planning, and action?

In this manner the cycles will be continued and form a spiral, as illustrated in Fig. 3.

In every AR project, two cycles are running in parallel. The first cycle stands for the before mentioned, while the second one is a reflection cycle, evaluating the original AR cycle (Coghlan and Brannick 2014). Zuber-Skerrit and Perry (2002) describe this as the core and the thesis AR cycle. This means that as well the design, planning, implementation, and evaluation regarding the proceeding and learning within the project have to take place. Herewith, the action researcher can evaluate how steps are conducted and, if they are consistent, how the following steps shall be executed. Argyris (2003) argues that the investigation of AR cycles itself is essential for the development of applicable knowledge. It's the dynamic of recurrent reflection that generates the learning process of the AR cycle. Thus, AR goes beyond trivial problem-solving and enables learning about learning, the so-called meta-learning. Coghlan and Brannick (2014) relate to three kinds of reflection in the AR process: reflection regarding the content, the processes, and the premises. Figure 4 illustrates the connections of reflection types as meta-cycle of core AR.

Reflection regarding the content analyzes the framework, the planned and the implemented,

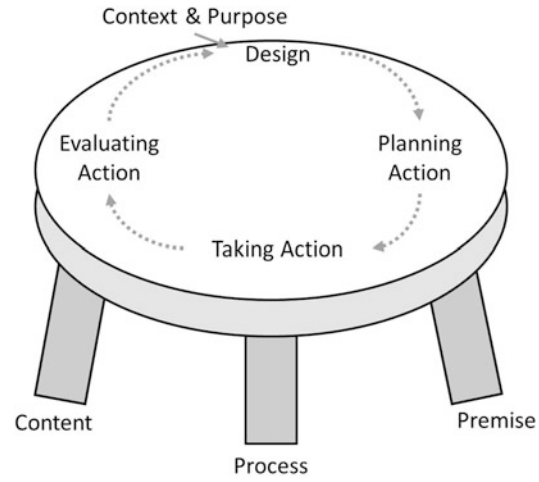


Action Research on Sustainable Development, Fig. 3 Spiral of action research cycles. (Source: Coghlan and Brannick 2014)

as well as the evaluated. The design and how it is carried out in planning, implementation, and evaluation are the critical focus of the process reflection. Finally, reflection of premises analyzes unformulated and unconscious assumptions that affect the attitudes and behavior of participants. Hence, this meta-cycle is the continuous monitoring conducted in every cycle, whereby continuous learning will be enabled (Coghlan and Brannick 2014).

Quality of Action Research

Action research requires its own quality criteria and cannot be assessed according to those of positivist research. According to Coghlan and Brannick (2014), high-quality AR includes three relevant elements: a good story, thorough reflection, and the extrapolation of useful knowledge or theory by reflecting the story. Not more than with other research methods, also AR faces a risk regarding validity. To guarantee a valid proceeding, the action researcher has to implement the AR cycles and test own assumptions and inputs from a critical public. Thus, action research has to combine advocacy and investigation; in other words, it has to integrate conclusions, attributions, perceptions, and openness for evaluation and critics. This combination includes deductions from observable data and the creation of deductions that can be evaluated, with the aim to enable learning (Coghlan and Coghlan 2002).



Action Research on Sustainable Development, Fig. 4 Meta-cycle of action research. (Source: Coghlan and Brannick 2014)

In the context of sustainable development, Egmose (2015) argues that a methodology focusing on change requires notably a reflection on how to implement change in real life. Thus, the demands regarding reflexivity are particularly high as the challenge of sustainability exceeds perceived boundaries and classifications. This means, the simplifications made to categorize actual situations may hinder a comprehensive assessment of sustainability issues and its impacts.

Applying Action Research to Sustainability Issues

Zuber-Skerrit (2012) puts the aspects relevant to sustainable development down to those that are as well inherent to action research:

- Engagement: The problem has to be identified and a need for change has to be observed.
- Value-driven agendas and planned interventions: Actions have to be specified and planned.
- Need for practical and sustainable change: Actions have to be implemented and reflected regarding their effects and impacts.
- Support of organizations and individuals to ensure continuation of the process: The new generated knowledge has to be identified and experienced as a learning outcome that affects future problem-solving capabilities.

In that sense, both sustainable development and action research aims at identifying a need for change and to support it with both rigor and relevant research to enable practical solutions (Baumgartner 2011; Zuber-Skerrit 2012).

Literature shows a broad range of applications where an action research approach was used to answer various research questions resulting from "real-world" problems in different stakeholder environments. Table 2 gives an overview of selected cases from recent years where action research was chosen as the research method. The review of the selected literature includes the identified "real-world" problem, where a need for change of the current practice was identified. The action level specifies the involved actors, which can be described as the "owners" of the problem. As action research aims at generating a practical solution for a specified group or community and generating new knowledge, also the outcome expanding actual theory will be illustrated.

The essence out of these studies can be illustrated by a statement from Bradbury (2001): "Action research can be of significant value in building capacity for, and in the study of, efforts in support of sustainable development. Action researchers can help further the conversations already underway through giving a common language to many of the trans-sectoral initiatives that include people from the cultural and economic realms, and then further telling these stories, be it through publication channels (which require further theoretical reflection) or through convening forums for public conversation." There are manifold shapes of problems and questions related to sustainable development. Documented approaches on how to develop solutions and implement them, while expanding existing knowledge and theory, can help to improve not only current practices but also transform systems in a wider sense toward sustainable development.

Critical Reflection on Action Research for Sustainable Development

From an epistemological perspective, a focus on sustainability includes scientists to acknowledge planetary boundaries and orientation toward an uncertain future, which has normative implications and is biased. Thus, researchers from both sustainability science and action research for sustainable development are questioned regarding their scientific objectivity. In this sense, action researchers in the pursuit of sustainability are not neutral analysts, whereby they are required to engage in self-inquiry and reflection (Wittmayer et al. 2013). This refers to the meta-cycle of action research which necessitates the careful reflection of the content, the processes, and the premises within projects (Coghlan and Brannick 2014).

One of the critics on AR is the popular belief that this method is nothing else than consulting disguised as research, which faces a serious problem for AR. Gummesson (2000) proposes four ways to distinguish AR from consulting:

- Consultants working with AR approaches have to conduct investigations and documentations more thoroughly.
- Researchers rely on theoretical consultants on empirical justifications.
- Consultants have to work under tense time and budget restrictions.
- Consulting is linear – order acceptance, analysis, action/intervention, order completion. In contrast, AR is cyclical – data acquisition,

Action Research on Sustainable Development, Table 2 Examples of action research applications to sustainability-related issues

Reference sources	"Real-world" sustainability issue	Action level	Theory outcome
Anderson (2015)	Improvement of the livelihood and empowerment for initiating problem-solving actions of rural communities	Local community/farmers from two rural municipalities in Guatemala	New knowledge relevant to farming practices and environmental conditions and identification of change agents/ promoters
Bolwig et al. (2008)	Integration of poverty, gender, and environmental aspects into value chain analysis	Actors in agro-food value chains in South Africa	Conceptual framework to integrate the "vertical" and "horizontal" aspects of value chains that affect poverty and sustainability; set of tools for action research in value chains
Bratt (2011)	Improvement of criteria development processes within eco-labeling and green procurement to make these instruments more supportive of sustainable product and service innovation	Swedish eco-labeling programs and governmental expert body for green procurement	Criteria development prototype widening the scope from currently known product impacts to long-term objectives toward sustainability
Burns (2016)	Development of sustainability leadership in a graduate leadership course	Students and pedagogues at higher education institutions	Key pedagogical elements to support the development of sustainability leadership in higher education courses
Hallstedt and Isaksson (2017)	Assessment of the material criticality in the early phases of sustainable product development	Product design team at an aerospace company in Sweden	Material criticality method to assess criticality from an availability and sustainability perspective
Hasan et al. (2017)	Identification of the potential of information systems (IS) to impact, support, and transform the planning and execution of climate change adaptation activities	Climate change working group (CCWG) of the state government of New South Wales, Australia	Mediating role of IS tools and techniques in climate change adaptation
Richert (2017)	Closing the energy efficiency gap in SMEs	Management and environmentally aware employees of a car service and retailing company in Germany	Six-step energy management framework to implement energy efficiency practices in SMEs
Robèrt et al. (2017)	Sustainable transport system development with a focus on electric vehicles	Diverse stakeholders with various competences from the transport sector in Sweden	Process model for transport planning and electric vehicles; applicable for sustainable community planning in general
Shapira et al. (2017)	Integration of strategic sustainable development perspectives throughout design thinking processes	Experts in the field of design thinking	Sustainable design thinking prototype suggesting a process for integrating sustainability aspects on different levels
Tschiggerl and Topic (2018)	Closing the energy efficiency gap in energy-intensive industries by the identification of efficiency potential	Management and energy managers from the foundry industry in Austria	Transdisciplinary energy management model to identify energy efficiency potential in energy intensive industries
Velenturf and Purnell (2017)	Improvement of the way that waste is valued as a resource based on a system approach	Diverse stakeholders from academic, industry, and government partners from the resource recovery from waste program in the UK	Knowledge creation regarding stakeholder engagement for waste and resource management programs

feedback to involved persons, data analysis, action planning, intervention, and evaluation followed by a next cycle.

Despite this differentiation, Velenturf and Purnell (2017) see consulting as one method to achieve commitment and collaboration within participatory approaches. Stakeholders should also be engaged in other levels of participation – from informing to full autonomy – which are appropriate to their influence and interest. Further, they conclude that radical and transformative change, as it is required for the transition from unsustainable to sustainable states (see also Zuber-Skerrit et al. (2013)), demands participative processes. This shows several benefits regarding the quality, legitimacy, and efficiency of interventions:

- Improvement of social inclusiveness and empowerment of stakeholders.
- Promotion of social learning, whereby the connections between societal segments can be strengthened and adversarial relations can be transformed.
- The quality of information and solutions can be improved due to their adaptation to specific contexts.
- The acceptance and commitment to solutions can be increased.

Despite the positive effects of action research, it is a great challenge to researchers to conduct this kind of research approach in terms of their ability to deal with community spaces and possible power differences, ethical dilemmas, and conflicts (Wittmayer et al. 2013).

Conclusion and Outlook

The aim of action research is to improve practice while contributing to theory. Action research does not distinguish between research and action but is research through action. In contrast to traditional research approaches, action research is thus imprecise, uncertain, and possibly more volatile in its application (Coghlan and Coghlan 2002). A great number of applications from literature, as well as the statements of several authors, evidence the relevance of action research on sustainability-related issues. To lead social systems, which may be located at micro- or macro-levels, toward a sustainable development, coordinated change, cooperation, and collaboration are required from multiple actors across society. The role of academia can be to facilitate such processes through participatory action research in all sustainability-related fields (Velenturf and Purnell 2017). As concluded by Manring (2014), there is a clear need to educate and train students to participate as leaders and partners in sustainability initiatives, among others, by action research and practice.

> Action research expects us to stop just going through the motions, doing what we've always done because we've done it, doing it the same way because we've always done it that way. Action researchers take a close look at what they are doing and act to make things better that they already are. Taking a closer look is action in and of itself and that research, that knowledge creation – any action taken based on that research – has the potential to transform the work that we do, the working conditions that we sweat under and, most importantly, the people who we are. (Coghlan and Brannick 2014)

Especially in times of upheavals – political, social, economic, and technological – and on the threshold to a fourth industrial era, action research can make great contributions to shape and pursue this change in all its facings for the good of all involved in a sustainable way. The understanding of how this can be realized in the most sustainable way while adopting it in the forms of applied practices is the aim of any action research (Tschiggerl 2017). In the words of Zuber-Skerrit (2012), action research is a solution to and integration for problem-solving and sustainable development in a world of turbulence.

Cross-References

- ▶ Innovative Approaches to Learning Sustainable Development
- ▶ Deep Learning on Sustainable Development
- ▶ Reflective Actions for Sustainable Development
- ▶ Reflective Practice for Sustainable Development

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Adult Developmental Psychology

▶ How Worldview Development Influences Knowledge and Beliefs About Sustainability

Aesthetic Inquiry

▶ Arts-Based Approaches for Sustainability

Aesthetics

▶ Arts-Based Approaches for Sustainability

Aesthetics and Sustainability

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Introduction

Common current English usage of "aesthetics" usually means "pretty" and almost always relates to visual perception. With this simplistic understanding, the idea of aesthetics is evident in connection with many disciplines. Anthropologists are often called upon to curate museum displays of cultural artifacts, dance and theater rely on visual elements of costume and sets, maps are fundamental in geography, and the study of history may rely on illuminations and handwriting in manuscripts. Even the sciences have a role for aesthetics: the visual representation of molecules helps make sense of the otherwise inaccessibly microscopic world of atoms in chemistry and physics, while biology and natural history have long relied on artistic representations of life forms of all types to explain concepts and disseminate findings. Even in the more abstract worlds of data and statistics, in disciplines such as sociology and mathematics, the elegant, logical, and truthful display of graphic information is crucial. Given this wide array of academic relevance, it should be no surprise that aesthetics has an important role in environmental and sustainability studies and in the context of institutions of higher education.

Understanding "aesthetics" in relation to sustainability requires that we consider broader meanings of this keyword. Yet the study of aesthetics is vast: its disciplinary range is wide, so an explicit aesthetics can be traced for a few centuries in the Western context – although the idea more generally is fundamental to most life forms on the planet (not just humans) and thus could be endless in its scope. In the present article, a brief review of the etymology of aesthetics will help to broaden the definition from the simplistic "visual beauty" to a more robust and meaningful term regarding sensory perception. Thereafter, a brief review of aesthetics in a variety of general sustainability contexts will expand the concept beyond the visual and into a multisensorial understanding. Mitchell Thomashow has emphasized the synergy of aesthetics and sustainability for universities and colleges, and his work will serve as a useful case study to deepen the understanding and relevance of aesthetics for sustainability in higher education contexts. Aesthetics is a useful, if unusual, concept for a great variety of advocates, practitioners, and theorists of sustainability.

Definition and Etymology of Aesthetics

Notwithstanding the commonplace usage of aesthetics meaning "visual beauty," philosophers and critics use the term with varied and more robust meanings. The term aesthetics is derived from the Ancient Greek αἰσθητικός, relating to sensory perception, and it entered into modern usage in the eighteenth century via the German philosopher A. G. Baumgarten, who defined the term in two ways: the "science of cognition by the senses" and the "criticism of good taste" (*OED*, s.v. "Aesthetic"). The broader historical meaning of "sensory perception" is helpful to understand applications of aesthetics in sustainability because it does not limit the meaning only to "beauty" or the sense of sight (or to criticism or science). Rather, this meaning of "sensory perception" can also relate to not-beauty, to the personal or social, to all of the senses, and to emotional responses to such perceptions. (Although beyond the scope of this essay, it could also be applied to the sensory perceptions of nonhuman organisms.)

Sensory perception and subjective reactions are fundamental to human arts and culture – from the fine and performative arts to food and architectural traditions and from folk and popular to religious and elite cultures. It is also helpful to conceive of aesthetics in both subjective (individual, emotional) and objective (collective, rational) ways, which correspond to Baumgarten's two uses. Thus, in addition to the more common subjective understandings (as with the expression "beauty is in the eye of the beholder"), and even the less common scientific approaches to perception, aesthetics can also enter the more common sustainability realms of policy and science. For example, oral rhetoric and written language are important for crafting, proposing, and disseminating policy ideas (Romm 2012); and aesthetics play a significant role in the presentation and understanding of quantitative data (Tufte 2001).

Aesthetics is widely understood to relate with ethics, which takes it well beyond the mere "pretty" and into the realm of justice and fairness, which are central to sustainability. The aesthetics-ethics connection is perhaps most evident via religion (see below), but American ecologist Aldo Leopold linked aesthetics and ethics in a biological context that would come to be known as sustainability. His widely cited concept of the "land ethic" has become a central tenet in environmental philosophy. "The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land" (Leopold 1989, p. 204). Leopold insists we must "examine each question in terms of what is ethically and aesthetically right, as well as what is economically expedient. A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise" (pp. 224–225). In this influential formulation, Leopold expanded ethics from an anthropocentric perspective to a more ecocentric one while also arguing for including aesthetics and ethics in decisions regarding land management (i.e., sustainability). Leopold took up this topic also in his chapter on the "Conservation Aesthetic," which emphasized perceptions of experiences in nature (e.g., tourism, hunting, farming) and thus furthered the connections between aesthetics, conservation ethics, and ecology.

Building similarly on environmental philosophy and ecology, Thomashow (2014) summarized aesthetics as "concerned primarily with the extent to which beauty (or ugliness) is inherent or whether it is in the eye of the beholder, and the moral implications of such distinctions" (p. 205). This moral element is a key feature of education for sustainability, which institutions of higher education effect through both curricular and operational elements on campus. Thomashow's approach to aesthetics is moral/ethical, particularly related to education for sustainability. Moreover, his conceptions of art and sustainability aesthetics (discussed below) are based primarily, although not exclusively, in visual understanding. Aesthetics in relation to sustainability, however, is a necessarily broader, pan-sensorial, and more interdisciplinary topic.

Aesthetics in General Sustainability Contexts

Taking a multisensorial approach related to human arts and culture, aesthetics is evident implicitly and

explicitly in a wide array of disciplinary pursuits, all of which have relevance to sustainability efforts in the operational and curricular sectors of higher education. Although a comprehensive survey is out of the scope of this entry, a selection of these disciplines includes design, art, literature, music, food, tourism, religion, philosophy, and nature protection. Of these, design and art together with food, tourism, and philosophy stand out as particularly rich fields of inquiry and practice that blend aesthetic and sustainability matters, although nature protection efforts have been synergistic and influential.

Design is a key realm for the connections between aesthetics and sustainability. In architecture, industry, planning, and allied fields, sustainability has often been seen as something that is about functionality but not beauty. Consider, for example, energy efficient but clunky cars or drab colored but responsibly sourced and organically produced fabrics. Meanwhile, designers have emphasized beauty at the expense of environmental and social impacts: important architectural monuments end up wasting materials and energy, clothing is stylish but exploitative, or furniture is appealing to look at but not pleasant or safe to make or to use. Contrary to such trends, Lance Hosey (2012) makes the case that sensory appeal is necessary to life and not at all superficial. As sustainability integrates culture and nature, and as aesthetics is fundamental to both, then sustainability must have an aesthetic dimension. Hosey claims that productively joining aesthetics and sustainability "could save the planet" (p. 7). "Reversing the devastation of nature requires reversing the devastation of culture, for the problem of the planet is first and foremost a human problem. We created the crisis, but we can correct it – by appealing to both morality and sensuality, to both sense and spirit, together. Designers can promote sustainability by embracing what they have always cared about most: the basic shape of things" (p. 10). As Tufte (2001) put it succinctly, "Design is choice" (p. 191); as such, in crafting humanly constructed environments that govern so much social interaction and natural resource use, designers choose to include or exclude sustainability considerations.

As with design, the arts – drawing, painting, photography, sculpture, and other fields – rely predominantly on visual aesthetics. The twentieth century has seen the rise of the connections between aesthetics and sustainability in the field of eco-art, which, similar to design, is a prominent pathway for exploring such synergies. Linda Weintraub (2012) justifies writing an eco-art textbook to pursue sustainability by elaborating the following linked points: the environmental crisis is humanity's most important contemporary challenge; eco-artists have excellent communication skills and can advocate reform and preservation; humans draw inspiration from art that can create positive behavioral change; it is necessary to develop creativity that aids problem-solving and that is life-sustaining; and we need art that serves as a cultural conscience (p. xiii). Eco-art is process or mission focused, rather than stylistic or content oriented; further, it is ecocentric rather than anthropocentric. There are four principle ways that art can relate to ecology. First, the topics of eco-art works "are derived from the rigorous methods of ecologists and the subjective considerations of environmentalists" (p. 6). Ecologists's sources include nonhuman organisms, the nonliving environment, and human actions, all within any temporal or spatial context; environmentalists add intuition, opinion, and interpretation. Second, eco-art makes contextual interconnections, which involve "the inescapable law of links and relationships that govern all materials, all processes, and all events on Earth" (p. 6). Synonyms for such interconnections include symbioses, systems, networks, feedbacks, etc., and new such interconnected disciplines include "[b]ehavioral ecology, urban ecology, social ecology, acoustic ecology, political ecology, industrial ecology, Christian ecology, and media ecology" (p. 7). Third, eco-art involves dynamism, which is the idea "that anything occupying space also transforms through time" (p. 7). Eco-art therefore involves action and change rather than just static objects and ingredients. Finally, ecocentrism guides interpretation and decision-making in eco-art. Ecocentrism is "the principle that humans are not more important than other entities on Earth" (p. 7), and it is opposed to anthropocentrism, which prioritizes humans. Within this eco-art framework of aesthetic work for sustainability, Weintraub provides 47 case studies of

"twentieth-century eco art pioneers" and "twenty-first-century eco art explorers" (p. xiv). One of the 13 pioneers is Friedensreich Hundertwasser (Friedrich Stowasser), a designer and architect who railed against rational modernism and promoted the integration of literal and metaphorical natural biological systems into buildings – and thus was "an early practitioner of biomimicry" (p. 85). His *Hundertwasser House* is a public housing complex in Vienna that has green roofs, compositing toilets, and a living machine to clean water, varied (and user-altered) exterior decorations, stipulations for nonhuman "tree tenants," and, perhaps most astonishingly, no straight lines or flat planes. Of the 34 explorers, consider just 3 brief examples. Chinese artist Lilly Yeh worked with war-torn Rwandan Tutsis to help heal spirits, communities, and local environments through art and social action projects that included water treatment and sanitation facilities, renewable energy production, cooperative employment, microlending, and agricultural and human health. The projects melded metaphorical aesthetic elements (such as mosaics to represent rebuilding after fragmentation) with a dynamic dialogue between villagers and the artist to achieve practical, sustainable, and beautiful outcomes. As the "Tissue Culture & Art Project," the Finnish Oron Catts and the British Ionat Zurr established in Western Australia their bio art research laboratory SymbioticA, which now hosts over 70 research residents. The Project involves culturing cells to create "victimless" leather and meat and to address the ethical, social, and environmental problems of consuming and manufacturing products made of animals. Works from the Project have been exhibited in the Museum of Modern Art in New York City – and have even been prepared by chefs and consumed! Artist Amy Franceschini and environmental scientist Jonathan Meuser teamed up to develop and display the "DIY Algae/Hydrogen Bioreactor Kit," which addressed the need for small-scale production of hydrogen for renewable energy. The Kit addressed both the scientific challenge of using algae to efficiently split water into oxygen and hydrogen as well as the psychological challenges (associated with fear of hydrogen bombs) of distributed hydrogen storage and use. In addition to an exhibit displaying the backyard-scale and down-home elements of the Kit, the duo made available free plans (in the form of a punk rock zine rather than a technical manual) for citizen artist/scientists to further such renewable energy testing and research.

Eco-art certainly involves senses beyond just the visual, such as tactile elements of Hundertwasser's undulating floors or the taste of Catts and Zurr's artificial meat. Other disciplines and fields of study are helpful to broaden predominantly visual aesthetics into the emotional, aural, and gustatory. The literary field of ecocriticism has been applied broadly to a great variety of cultural products – from legal texts to films, from advertising to drama, and from poetry to prose. Inspired by movements in sustainability and environmentalism, ecocriticism seeks to understand how we represent human-environment relationships and the emotional responses we have to such representations (Garrard 2004, 2014). Building on ecocriticism, the field of ecomusicology considers music and sound studies in relation to ecology and the environment (Allen and Dawe 2016). These fields along and others such as media studies have broadened to consider the natural resource implications of their subjects, as with the sustainable and unsustainable woods used for musical instruments (Allen 2012), the materials necessary for music recordings (Devine 2015), the production and afterlife of digital technologies (Cubitt 2017), and how the pleasures of food relate to sustainability and literary study (Philippon 2012).

Food, in fact, is more than just a basic necessity of human existence: it is also a central element of human aesthetic experience, as the Slow Food Movement has made so prominent (Philippon 2012). Furthermore, food systems are a regular concern for sustainability efforts (e.g., Alkon and Agyeman 2011). As the topic of food so fundamentally synthesizes aesthetics and sustainability, so too does the topic of tourism. The largest industry in the world, tourism, involves the pursuit of a variety of aesthetic experiences, often with significant environmental and social impacts. The sustainable tourism industry has arisen to address this challenge, and international agencies such as the World Tourism Organization of the

United Nations have aimed to address the United Nations' Sustainable Development Goals through responsible tourism (Edgell 2016).

Studies of religion and philosophy have also contributed to synthesizing aesthetics and sustainability. As Viladesau (2014) has outlined, the arts function both as theological texts complementing the written word and as communication strategies containing religious messages that connect with ethics. Religious thinkers regularly link aesthetics, religious belief, ethical behaviors, and sustainability efforts. In the Catholic Church, Pope Francis has taken a strong position advocating the place of sustainability efforts in care of both human life and the nonhuman world, and these are intimately related to the practices, traditions, and cultures of Christianity. Such efforts exist in many different religious traditions. As scholars of religion Mary Evelyn Tucker and John Grim (2007) put it, "though science and policy approaches are clearly necessary, they are not sufficient to do the job of transforming human consciousness and behavior for a sustainable future. Values and ethics, religion and spirituality are important factors in this transformation."

In addition to religious traditions, the connections of aesthetics and ethics relate especially to secular philosophical inquiry. Philosophy is the disciplinary home for the separate fields of aesthetics and of ethics, and as a subfield of the latter environmental ethics is of great importance to sustainability. Ethics and aesthetics are connected by more than just a shared disciplinary home; they come together primarily through the concepts of judgments and values: judgments of beauty or the value of artistic goodness or judgments of duty and the values of how actions can be good. Plato's concept of *kalon* synthesized physical beauty and moral goodness in a singular, inseparable concept. In neo-Kantian moral philosophy, one can understand that the arts provide a sort of moral education via the senses. In these ways, aesthetics and ethics are inseparable and help "in thinking about the artful and meaningful construction of a life" (Eldridge 2005, p. 731).

In relation to sustainability, such aesthetic-ethical thinking is evident in environmental aesthetics and natural aesthetics (Fisher 2005). Environmental aesthetics considers an environmentalist approach that has been informed by thinkers such as Henry David Thoreau, John Muir, and Leopold, among other people and that can be seen in, e.g., Thomashow's advocacy for aesthetic sustainability (below). Natural aesthetics considers human emotional and ethical responses to features of natural and built environments; it is less concerned with advocacy for environmental and sustainability purposes, although natural aesthetics responses may certainly lead to such advocacy. These two paths – environmental aesthetics and natural aesthetics – are most evidently related to each other and to sustainability in Allen Carlson and Sheila Lintott's (2008) anthology *Nature, Aesthetics, and Environmentalism: From Beauty to Duty*. The authors in this volume trace the centuries of connections between these concepts and explore particular ramifications in the contemporary world. J. Baird Callicott observed that natural aesthetics influenced environmental aesthetics, especially with regard to American preservation efforts. Such influence is distinct from more utilitarian conservation efforts (i.e., for resource availability) that relied significantly less on aesthetics. In fact, Callicott claims that beauty (in terms of natural aesthetics) has been much more influential than duty (in terms of environmental ethics) (in Carlson and Lintott 2008 and in Callicott 1994).

Nature protection efforts (especially preservation, in distinction to more utilitarian conservation) include both aesthetic appeals and instrumental scientific arguments. Perhaps it is more common to see advocates relying on the more objective elements of ecological studies, measurements of pollution, demonstration of harm to humans and other life, and the usefulness of nature to humans (e.g., clean air, clean water, resources for food and shelter, etc.). But such protection advocacy also relies on more subjective claims about aesthetic experiences. For example, the Wilderness Act of 1964 (USA) established human "enjoyment of wilderness" as a foundation for the Act (Section 2a). In defining wilderness, the Act stipulated that such a place "may also contain ecological, geological, or other features of scientific, education, *scenic*, or

historical value" (Section 2c, emphasis added). Similarly, the National Environmental Policy Act (NEPA) of 1970 (USA), which has been a model for other nations' similar efforts, also draws on aesthetic concerns regarding the "*enjoyable harmony* between man [*sic*] and his environment" (Preamble, emphasis added). In the international arena of nature protection, the framework for the Millennium Ecosystem Assessment (MA) incorporated aesthetics with regard to the cultural services of nature. Although the idea of "ecosystem services" predates it, the MA synthesized and made the ecosystem services idea more widespread. Ecosystem services are those "benefits people obtain from ecosystems" (Alcamo et al. 2003, p. 3). The MA organized such ecosystem services into provisioning (food and fuel), regulating (climate maintenance and water purification), supporting (soil formation and nutrient cycling), and cultural. The cultural services are those "nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences" (p. 8). By incorporating aesthetics and culture into their framework, the MA makes the case that detrimental changes to ecosystems (i.e., through contamination, depletion, extinction, etc.) result in "negative impacts on cultural life and human experience" (p. 77). Such nature protection efforts rely on objective science, and they make subjective ethical and aesthetic appeals to achieve their ends.

Addressing climate change is a twenty-first century approach to nature protection, and Roman Krznaric (2010) offers an argument for aesthetics that links knowledge and action with aesthetics and ethics. Krznaric makes the case that, in order to bridge the gap between knowledge of and action on climate change, we do not need just more or better economic or moral arguments; rather, we need more empathy across space and through time. In short, confronting "climate change requires nothing less than a revolution of the empathetic imagination" (p. 155). Empathy can be understood either as a shared emotional response (affective empathy) or, the idea that is more important for Krznaric, as perspective taking (cognitive empathy). To achieve social equity and more just political systems, we need more empathy (as, e.g., happened with the fight against slavery). To generate more empathy for people and places distant to us in time and space, Krznaric proposes an approach to education that relies on aesthetics: novels, stories, films, the arts, etc., as well as conversations and direct experiences with other people, e.g., through tourism and cultural exchange. Thus, aesthetic experiences generate emotions and perspectives to increase empathy, which in turn is channeled to addressing climate change – showing yet another role for aesthetics in sustainability.

Aesthetics and Sustainability in Higher Education

Connecting aesthetics and sustainability has been well developed and widespread, although there has been less attention given to the specific relationship of aesthetics and sustainability in the context of institutions of higher education. Mitchell Thomashow, the former president of Unity College, Maine (USA), is one leader who has given significant attention and thought to connecting sustainability and aesthetics in higher education.

Thomashow groups the chapters of his *Nine Elements of a Sustainable Campus* (2014) into three categories: infrastructure (energy, food, materials), community (governance, investment, wellness), and learning (curriculum, interpretation, aesthetics). The book hinges on the idea of higher education promoting the sustainability ethos: "a spirit of creative innovation in support of civic responsibility and ecological resilience" (p. 7). The concluding chapter on aesthetics begins with a discussion of the Art of Stewardship Project, and Thomashow relates an anecdote about when Unity College made the campus into a "canvas for art that conveys, expresses, and inspires ideas about sustainability, stewardship, and ecology" (p. 191). In this case, aesthetics is about using the visual arts to engage communities about sustainability and to further educational efforts. Yet Thomashow makes it clear that the synergies of aesthetics and sustainability can be

much more than straightforward audience engagement for education and outreach. In fact, a sustainability aesthetic supports the sustainability ethos. His argument for a sustainability aesthetic develops out of a series of concatenated points: the arts enhance biospheric perception, imagination is a foundation for creative sustainability, art can transform culture, and both human values and natural principles inform a sustainability aesthetic.

Biospheric perception results "in a state of enhanced wonder" (p. 193). Learning about complex planetary processes (e.g., biogeochemical cycling, atmospheric patterns, biodiversity, evolution, natural history, etc.) is a foundational part of biospheric understanding, which supports a sustainability ethos. When learning about the biosphere, the addition of aesthetic elements – lyrical text, visuals, metaphor, soundscapes, dance, etc. – accentuates an individual's biospheric perception. Building on the subjective foundations of aesthetics, Thomashow writes in the first person to elaborate on the enhanced sensory capacity of his biospheric perception as inspired aesthetically: "I'm more likely to pay attention to phenomena that I typically take for granted. I have a broadened view of ecological space and geological time. I'm further compelled to use my artistic imagination to interpret, express, and communicate these impressions" (p. 193). Because a "basic understanding of biosphere processes is fundamental to well-conceived sustainability initiatives" (p. 194), and because such processes are difficult to grasp, the addition of aesthetics helps both with basic learning and with the higher-order effort of eliciting wonder. Studying the environment (or people, or anything), through art improves and heightens an individual's capacities and responses. Thus art "can transform everyday observations," and through arts "the campus cultivates the imagination" (p. 195).

Imagination has been significant in science and natural history. Scientists have had new ideas and made discoveries as a result of artistic and literary inspirations. Concomitantly, artists and creative thinkers have fueled their work with the discoveries of science. Such mutually reinforcing exchanges converge to fuel imaginative creation in all realms, and they "provide a conceptual foundation for an aesthetic and educational approach to sustainability" (p. 197). If the aim of sustainability is to "improve the quality of human life," then we must be able to "project a vision of what is possible" – and that "requires imagination" (p. 197).

Imagination fuels creative sustainability, which involves the virtuous integration of human possibility and ecological possibility. Creative sustainability "aspires to apply ecological principles and awareness to human behaviors and decisions, linking the quality of human life to the evolving biosphere" (p. 200). As process, creative sustainability also brings out the "emotional challenge" of pursuing sustainability. Despite, or precisely because of, such personal impacts, creative sustainability "requires community collaboration" and intergenerational processes (p. 201).

Thomashow advocates various imaginative forms to manifest such creative sustainability, but he focuses on his own experiences with the Art of Stewardship Project, which used "art as a vehicle for campus transformation" (p. 201). In essence, "Sustainability art has the potential to creatively transform the culture of a campus ... by tangibly illustrating sustainability principles in multiple settings, using a variety of artistic mediums, and engaging all campus constituencies" (p. 201). Rather than keeping artistic practices and displays private (in galleries, studios, residences), they should be interactive, public, and engaged with sustainability topics. A portfolio of potential art projects (pp. 202–205) includes graffiti, recycled sculpture, landscape art, soundscape designs, and installations inspired by the work of the artist Andrew Goldsworthy. The campus canvas "becomes a template for innovation, imagination, and experimentation, conjuring the art of the possible, linking research and learning to campus infrastructure, while encouraging broad participation" (p. 202).

Such an approach takes complex ideas understood via biospheric perception and imagination and presents them in an educational context for the ultimate goal of changing culture. A sustainability aesthetic is both a driver for and the result of such an approach. A sustainability

aesthetic "implies that our conception of what is elegant and beautiful is informed by sustainability principles, which are in turn derived from ecological patterns and processes, and ultimately biospheric processes" (p. 205). Extrinsic and intrinsic influences form an individual's sustainability aesthetic. Extrinsic factors include values from sustainability practices and behaviors, such as energy use, material composition, location and process of manufacture, durability, etc. They are not direct reflections of beauty but do inform aesthetic preferences – why, for example, a field of solar panels may be more appealing than a coal-fired power plant. Intrinsic factors involve "how aesthetic appeal is informed by patterns in nature" (p. 206), explored in such fields as nature photography, landscape painting, sustainable architecture, green design, biomimicry, etc. Developing a sustainability aesthetic involves both cultural perspectives (extrinsic factors) and biospheric perceptions (intrinsic factors).

Thomashow is careful to note that not all intrinsic factors of nature are appealing, as with invasive species and catastrophes. Moreover, not all extrinsic factors, such as knowledge of clean power, make wind turbines inherently beautiful. It is difficult to define what is appealing for everyone because each individual has a different set of experiences and backgrounds that influence taste. Even then, scale and place can change an individual's tastes further (as with the example of a large-scale wind farm on a distant hill versus in one's own backyard). Nevertheless, "it is important to recognize the extent to which our values predispose aesthetics" (p. 207). Thus, a sustainability aesthetic is not a predetermined truth. Rather than seeking some perfect or correct aesthetic position, the "more important issue is how and whether the art of sustainability can change the way we see the world" (p. 208) and hence influence such a sustainability aesthetic. Thomashow believes that, indeed, "art can change the way we see the world because it challenges us to find beauty in unexpected places" (p. 210). The college campus should be a place for art because it supports the educational mission of all disciplines and especially "sustainability initiatives, ecological processes, and biospheric principles" (p. 210).

According to Thomashow, the "ultimate rationale" for advocating aesthetics and sustainability together is that art "changes the way we see the world, it makes the world more meaningful, it provokes astonishment and delight, it inspires scientific inquiry, and it encourages human flourishing" (p. 210). The practical upshot for institutions of higher education pursuing aesthetic sustainability is that "sustainability art improves the quality of campus life, has the potential to enhance our understanding of the basic principles of sustainability, and facilitates collaboration and community. Ultimately, sustainability art promises a deeper awareness of how we understand our relationship to nature" (p. 209).

Conclusion

Aesthetics may seem an unlikely, even impotent, source for the profound changes necessary to move toward sustainability, on campus or anywhere else in the world. But as this entry has shown, there are numerous ways for aesthetics to connect with ethics and, in turn, to impact knowledge, emotion, and action in the face of human-environment challenges. Aesthetics and ethics are germane to sustainability efforts on campuses due to higher education institutions' environmental and social impacts, locally and globally, as well as their educational missions, which result ultimately in cultural changes for sustainability. Explicit integration of aesthetics into sustainability at the institutional level in higher education is an uncommon approach, but the University of North Carolina Greensboro (USA) does so with its official campus definition of sustainability: "the enduring interconnectedness of social equity, the environment, economy, and aesthetics" (n.d.). This definition applies to learning, operations, and service throughout the institution. Implicit evidence of approaches integrating aesthetics can be found throughout the higher education sustainability movement, but more explicit efforts could be brought to bear on creating a culture of sustainability. To paraphrase Thomashow (2014, p. 209), the synthesis of aesthetics and sustainability makes campuses better and more beautiful places,

which in turn helps change culture and move toward a better and more beautiful relationship between people and planet.

Cross-References

- ▶ Arts-Based Approaches for Sustainability
- ▶ Art-Based Teaching on Sustainable Development
- ▶ Cultural Sustainability in Higher Education
- ▶ Intangible Assets and Sustainable Development

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Anthropocene and Sustainable Development

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Definition

The Anthropocene is the name given to the set of changes and transformations through which the planet Earth has passed during the last century or so and that have reached such a profound magnitude that several scientists and researchers affirm that the planet has entered a new geological era.

These transformations can be seen and experienced in processes as the fast and vast urbanization process all over the world, growth in social and economic inequality rates like never seen before, wider and deeper overexploitation and scarcity of natural resources (soil erosion, water pollution, use of oil and other fossil fuels as main energy source by an increasing number of people), ecosystems degradation, and a higher incidence of phenomena like hurricanes, storms, droughts, floods, and high risk natural disasters in general, as well as the extinction of animal and vegetal species in unforeseen speed and proportions. Its comprehension is fundamental to discuss and to plan strategies and global action to achieve sustainable development and to assure the survival of our species through the adaptation to new environmental conditions.

Introduction

Nowadays, the transformations through which the planet Earth has passed have become increasingly visible, especially its consequences on the environment and on society as a whole. Examples of these transformations can be seen in processes such as: the fast and vast urbanization process all over the world, growth in social and economic inequality rates like never seen before (Buttel et al. 1985; Galtung 1979; Tucker 1982; Ophuls 1977), wider and deeper overexploitation and scarcity of natural resources (soil erosion, water pollution, use of oil and other fossil fuels as main energy source by an increasing number of people), ecosystems degradation, and a higher incidence of phenomena like hurricanes, storms, droughts, floods, and high risk natural disasters in general, as well as the extinction of animal and vegetal species in unforeseen speed and proportions. These changes have reached such a profound magnitude (Osborn 1953), that several scientists and researchers affirm that the planet has entered a new geological era, which is called the Anthropocene.

Anthropo is a word of Greek origin which means man or human being while *cene*, also of Greek origin, means era or new, being mostly common used for geological eras. Thus, in a general sense, anthropocene can be understood as the "Human Being Era," meaning that humans have developed and reached such a potential to change the environment (both social as natural) that the species became the most important driving force of the planetary transformation processes but has not the full control over them. However, before getting into the main topic of this text, it is important to better understand the previous Era and why it has changed.

Scientists called the last 12–10 millenia until now as the Holocene Era, a period of time mainly characterized, in human species' perspective, by the transition from nomadism, when our ancestors were basically hunters and gatherers wandering around the planet to sedentary and organized societies influenced by the discovery and control of fire, which was essential to heating, cooking, and pottery processes, and tools manufacturing. In general, it already represents a huge transformation of the relationship between humans and nature, as long as humans were able to produce food through agriculture and domesticated animals. It was also a relatively stable period regarding global climate and environment changes, which helped humans to thrive developing both physically and intellectually.

There is yet another basic and essential feature that should be perceived and understood besides all the transformations aforementioned. It emerges if one highlights the role of the overuse of fossil fuels and its resulting emission and increased concentration of greenhouse effect gases on Earth's atmosphere, fact that did not happen in the Holocene at rates as high as the observed during the last 300 years. This aspect is very important to understand the global transition to the Anthropocene and will be better explained ahead.

What is Anthropocene in Theory?

Paul J. Crutzen, Dutch chemist and 1995 Nobel-prize winner, suggested in 2002 that mankind and the planet would have entered into a new age, that he called as the Anthropocene.

According to him, about approximately 300 years ago, from the Industrial Revolution scenario at the end of the eighteenth century, human action gained geological and morphological transformation potency, confirmed by the increased levels of carbon dioxide and methane concentration, causing the planet to migrate from the Holocene era to the Anthropocene (Crutzen 2002, 2006).

In addition to the fast industrial advance as one of the main characteristics of this transition, it can also be mentioned aspects as the potential of transformation and access of the human being to nature, in addition that there are also the consequences related to the population increase resulting from the urbanization process and the greater use of energy resources, mainly through the overexploitation of fossil fuels such as coal and oil, which is profoundly related to the higher levels of dioxide and methane concentration in the atmosphere, a keypoint to understand the Anthropocene debate. Crutzen suggests that Planet Earth in the Anthropocene has left its natural geological cycle, mainly, by pervasive human activities.

Considering these aspects of the transition from the Holocene to the Anthropocene, it is important to note that the preindustrial period is also marked by transformations in the relationship between society and nature, however, these impacts were transitory and restricted to a more local and reduced geographic scale. As stated by Steffen et al. (2007), preindustrial societies did not have an organizational structure in the economic, social, and technological spheres that allowed a real "domination" of nature and this is the main difference in relation to the dynamics of industrial and post-industrial societies.

It is essential to pay attention that, according to the main theorists in this topic, the Anthropocene has three stages: the first one takes place from the Industrial Revolution (between the eighteenth and nineteenth centuries) until 1945, the second is from 1945 (the end of the World War II) to 1960, and, from 1960 until the present, Earth is going through the third stage.

The first phase, which lasted until 1945, is marked by the process of industrialization with the implementation of new techniques and technologies not only in industrial production processes but also in agriculture with the increasing mechanization and use of pesticides and fertilizers, which allowed not only a significant and unprecedented increase in the production of food and other goods but also influenced the modification and degradation of the environment with the emission of noxious gases and deforestation, for example.

Since 1945, after World War II, the world is experiencing the so-called Great Acceleration of the Anthropocene. This context is marked, initially, by political and economic actions based on the reconstruction of the countries involved and devastated in the conflict. In this sense, beyond the recovery and modernization of the physical infrastructure, the period is also characterized by the implementation of high investments in key sectors related to social well-being of the population; more than this, it is paramount to highlight the role of policies to encourage mass consumption (and consequently the formation, expansion, reproduction, and consolidation of middle classes in central countries) as predominant and central to economic growth and social development (Keyfitz 1976; Kate 2000).

This historical period is also described as the phase of the Great Acceleration for other reasons, such as, the global population practically doubled during this period (this factor, in conjunction with the industrialization of the Global South and reindustrialization of the Global North processes, caused a rural exodus boom as millions of people headed to urban areas all over the world), economic development rates increased with an ample flow of capitals and trade in general (this period was also known as the Golden Age of Capitalism with high growth rates linked to state policies such as the Marshall Plan), the increase of oil and other fossil fuels consumption (for industrial processes and transportation systems, which was accelerated through the incentives given to the automobile industry and the popularization of the use of the car), the acceleration of the urbanization as mentioned and the advent of new technologies as never seen before.

After that, it is important to keep in mind that since the 1960s the planet started a transition to the third stage of the Anthropocene, also called

the "business-as-usual" stage. The main difference from the previous period concerns the role of the state in the economy, that is, until the 1960s, Keynesianism was predominant, especially in developed countries, in the sense that the state had a central role in controlling the economy. After this period, economic crises demonstrated the exhaustion of this model and the rise of a new mind-set based on neoliberalism, in which everything is defined and commanded through the actions and wills of the market, which regulates itself. In this sense, not only economics and politics would be and should be market driven but also the environment and its resources, which came to be treated as unlimited commodities, while the belief, or myth, that technology could solve any problem related to scarcity and environmental degradation spread and consolidated throughout the planet. Sky was literally the limit for Humankind (Schnaiberg and Watts 1980, 1986; McPhee 1989).

As discussed and highlighted by Crutzen, it is not possible to place a specific date for the beginning of the Anthropocene. Thus, the author relates the Anthropocene to the Industrial Revolution, because it is at this moment in history that the impacts of human actions on nature and the different societies (such as the smogs in London in the early 1950s and the diverse and growing problems of air, water, and soil pollution in large cities in developed countries, for example).

As a direct consequence of this hegemonic mind-set together with burning fossil fuels, the use of fertilizers and pesticides in agriculture, the intensive livestock breeding and deforestation, greenhouse gases have increased substantially in the atmosphere, altering rainfall patterns, causing increases in temperature and rising sea levels. These are some of the examples used to understand the potential of human activities.

Another aspect highlighted about the Anthropocene is that in the previous Era, the Holocene, environment impacts used to happen locally, and in the current Era, it occurs in a Global scale, by this way, gas emissions in some countries may affect the climate patterns in others as well, or the ocean patterns which may increase the incidence of storms and earthquakes, causing structural problems and people displacements, for example. Therefore, the overall consequences are considerably higher than in previous times, thus representing great challenges for the survival of Humankind and that is why understanding the concept is primordial.

In an attempt to getting a richer discussion, the concept that started in a chemistry circle is turning or getting space either in the human and social sciences discussions about the world, the sustainability and the future.

An example of this kind of approach was made by Amparo Vilches and Daniel Perez, who published in 2008 an article for the United Nations Decade of Education for Sustainable Development (2005–2014) which is associated to the United Nations Millennium Development Goals (eight global Goals adopted and assumed in 2000 for the twenty-first century).

In this text, the authors point out that it is important not only to pay attention to the consequences and risk situations but also to take it as an opportunity of changing the society mind-set and human being behavior in relation to nature and the environment (Vilches et al. 2008).

For understanding this process, it is important to bear in mind that human actions in the Anthropocene contextualization are connected to the economic system and how we explore the natural resources for our daily lives and the products our society consumes. The main problem of this equation is that natural resources such as oil, water, and soil are actually limited and they have been used as unlimited resources. For Vilches and Perez, acting as if Earth is a limitless resource warehouse and waste disposal facility boosts this whole scenario to an emergency situation. If nothing is done, there is a serious risk of another mass extinction on the planet.

When studying the Anthropocene and its main characteristics in relation to the impacts caused by the emission of greenhouse gases in the atmosphere, it is important to point out that these results are deeply felt by society, either by the transformations caused by climatic disasters or the scarcity driven by environmental changes such as pollution and soil erosion, for example. Thus, it is necessary to construct the

Anthropocene approach as an interactive system between nature and society (and all its economic, political and cultural dynamics).

Bruno Latour (2014) describes that there was a strong tendency to treat science and politics as divergent and strictly separate areas; however, for the author, the answer to the challenges would be deficient and would only loose with this type of relationship. In this way, Latour points out that one of the main challenges for the Anthropocene as a tool of analysis is to treat politics and science as joint areas, relating the factors with the concerns about how to face the problems.

From this perspective of integration, Artaxo (2014) reports that, in a general sense, Earth is surpassing the planetary boundaries, which would be the safe operating limits for the survival of humanity. In order to corroborate this idea, the author brings to the discussion the analysis of the "Great Acceleration" charts, where it is clear that the patterns of production and consumption of the current natural resources are determinant for the transformation of the planet and the population.

In 2010, Will Steffen published a work, which based the Anthropocene trajectory, according to the aforementioned charts of the "Great Acceleration." These charts were originally published in 2004 and extended in the year 2010. They were built and synthesized under the project of the International Geosphere-Biosphere Program (IGBP), which initially comprised the period between 1999 and 2003. Considering the considerations made by Paul Crutzen, the graphs demonstrate the transformations that occurred on the planet, both in biophysical and socioeconomic aspects between 1750 and 2000, especially highlighting the deep acceleration that occurred in the second half of the twentieth century.

The large-scale growth of the aforementioned elements can be easily related to socioeconomic trends charts. It can be seen that in the period between 1950 and 2000, the global population has practically doubled (something new in the history of mankind being given such a magnitude in such a short time); however, it is necessary to understand and analyze that most of this growth occurred in countries in the process of development. In this sense, one of the most paradoxical issues in this area is that, despite this growth occurring in developing countries, real GDP growth is much higher in developed countries, thus demonstrating the structural economic and social inequalities between the different groups. In addition, the sector of investments, transport, paper, water, and fertilizer use occurs on a larger-scale also in developed countries; however, the consequences of environmental changes are always more felt in places of greater economic and social vulnerability (Bankoff et al. 2004; Cutter 1996; Cutter and Emrich 2006; Cutter et al. 2003; Cutter et al. 2006; Galtung 1986; Jones 1993; Adger 2000).

The aforementioned discrepancies and contradictions are a central part of the analysis to understand the magnitude of the challenges in order to broaden the debate and its search for alternatives of mitigation and resolution of the problems, after all it is perceived that a generalist view that human action transforms the environment is limited as societies are diverse in structures and patterns. Therefore, it is noteworthy that it is substantial for the anthropocene to expand more and more into an integrative and systematic analysis.

Anthropocene and Sustainable Development

As discussed before, since 1945 at the end of World War II, industrial production has increased a lot, as well as its local, regional and global impacts. For this reason, since the 1960s, global warming has been at the mainstream world debate about environment, and this is why the concept of Anthropocene is so important nowadays as a way to conceptualize the global environmental changes, as well as their human dimensions.

Some researchers are attesting the need to understand the world as a system, in which society and environment are deeply related. It means that human actions and activities certainly may affect environment and their impacts will come in return to society as well. Authors as Crutzen affirm that the actions that characterize the Anthropocene will occur for thousands or millions of years yet.

This is an unknown situation, still though, this theory brings up to the debate a strategy to understand what is occurring, how to manage with, and, most importantly, how to adapt ourselves and our societies to it (Crenson 1971).

Rachel Carson launched her book "Silent Spring" in 1962, questioning whether we should actually use so many chemicals in pest control in agricultural production, and more than that, pointing to the fact that nature is fragile and that its equilibrium can be easily ruptured by human intervention (Ames et al. 1987). A series of researches began to bring attention to the risk that the human species was exposing itself by demanding more of the planet than it was capable of (Giddens 2009; Beck 1992). However, other voices rose to say that whatever was said about the risk of environmental collapse, the technology would be able to solve.

The 1970s represented a moment of growing concern for society regarding environmental issues. A series of major environmental disasters and the progressive deterioration of the quality of urban life have made the attention of people in general, the academic community and governments turned to the environmental dimension of development.

In 1972, in Stockholm, the United Nations Conference on the Human Environment took place. It was the first time that representatives of industrialized and developing countries met to discuss, exclusively and systematically, the issue of the global environment and the development of the planet. This conference has achieved significant results, such as the creation of the United Nations Environment Program (UNEP), the further development of a series of United Nations conferences focused on issues such as food, housing, population, human rights and the living conditions of women, and the promotion of the idea that it was necessary to change the way humans relate to the environment (United Nations Environment Programme 1981a, 1981b, 1986, 1987). A preparatory meeting for this conference that deserves attention, according to Sachs (1993), was what the author defines as "a memorable" Founex Meeting, Switzerland, in 1971.

In the same year, MIT published the report "Limits to Growth," (Meadows et al. 1972) produced by the so-called Club of Rome. The report explicitly pointed out the limits of economic growth because of its dependence on the non-renewability of most natural resources and proposing – polemically – "no economic growth" or "zero economic growth." Produced in a period marked by the fashion of using computer models of complex phenomena, the report was severely criticized for a number of reasons.

First, its conclusion condemned the Third World (which in 1972 was still a social, economic, and political reality) to eternal poverty. Without growth, there was no possibility of development. Secondly, the report completely ignored the demographic transition, incorporating linear extrapolations of vital rates at the time. The transition already foreseen by demographers (who just could not pinpoint their timing) had already begun, albeit timidly and imperceptibly (Ackerman 1959; Brown and Hutchings 1972; Brown 1981; Brown et al. 1999; Boserup 1965, 1981). However, the advances of demographic science, as early as the early 1970s, did not absolutely authorize this simplification. Third, other simplifications have been incorporated to compensate for the lack of data concerning the parameters of the model, especially regarding natural resources (Malthus 1998).

In 1974, in Cocoyoc, Mexico, the United Nations Conference on Trade and Development, which produced a document, the Cocoyoc Declaration, was considered by many authors as fundamental for the construction of a new perception of the relationship between society and nature, incorporating into the discussion the idea that there were environmental and social limits for development that should be respected.

Another event was held in Nairobi, Kenya, in 1982, this time focused on assessing what it had advanced in relation to the discussions in Stockholm. This meeting resulted in the formation of the World Commission on Environment and Development, which, however, was only concretely implemented in 1983.

In 1987, this Commission published the "Our Common Future" report – also known as

the "Brundtland Report" because the committee chair was then Prime Minister of Norway, Gro Harlem Brundtland – which a world conference to drive efforts to establish another form of relationship with the environment. For the first time, the concept of "sustainable development" was used which, according to the commission, was defined as "development that meets the needs of today without compromising the ability of future generations to meet their own needs."

However, this concept was not new, especially for the academic community. Since the early 1970s, a number of researchers, including Ignacy Sachs (1970, 1972, 1980, 1981, 1993), have been discussing the need for and urgency of change, particularly in relation to the production and consumption patterns of industrialized countries, in order to find ways of building in practice what some called ecodevelopment.

In 1992, in Rio de Janeiro, there was perhaps the most famous meeting of world leaders until then, the United Nations Conference on Environment and Development, also known as the Earth Summit, Rio Conference, Eco'92 or simply Rio-92. This conference was attended by 178 world leaders and produced a series of documents that synthesized the yearnings and concerns of the peoples of the planet regarding the environmental issue.

Among these documents, it is important to highlight Agenda 21, the Rio Declaration, the Declaration of Principles on Forests, the Convention on Biological Diversity, and the Framework Convention on Climate Change. The same conference resulted in the creation in 1993 of the United Nations system of the Sustainable Development Commission (SDC), which aimed to monitor the implementation of Agenda 21.

In 1997, Rio+5 or the Special Session of the General Assembly of the United Nations was hosted by the SDC in Cairo, Egypt, and its main objective was to review the implementation of the Global Agenda 21 so far. This conference identified a number of gaps related to the difficulties faced in pursuing social equity and reducing poverty on the planet. These difficulties were considered, according to the experts and scholars who attended the meeting, as a direct result of the reduction of international financial aid, the increase in external debts and the failure to improve Agenda 21 measures such as technology transfer, capacity building for participation and development, institutional coordination, and reduction of excessive levels of production and consumption. At this moment, the increasing need for ratification and more efficient implementation of international conventions and agreements relating to the environment and development has been strengthened.

In 2002, in Johannesburg, South Africa, the World Summit on Sustainable Development, also known as Rio+10, took place. The first analyzes, still produced in the heat of the events, indicated that perhaps this was the less effective and more empty of the big global meetings to discuss environment and development.

In 2012, Rio+20, also known as UN Conference on Sustainable Development (UNCSD), took place in Rio de Janeiro, Brazil. It is noteworthy that Rio+20 is quite significant because it represents not only the extent of Rio 92 discussions but also a debate center on what has really been effective and what needs to be improved. In this sense, for Sánchez and Croal (2012) it is important to highlight two of the main positive results of the 1992–2012 period: consolidation of the Environmental Impact Assessment (EIA) through a legal framework and legislation based on them in most countries, not only in the political-state environment but also in the international arena in organizations and institutions such as the World Bank and OECD and the Strategic Environmental Assessment (SEA) with development planning initiatives.

Sánchez and Croal point out that Rio+20 for some experts was not as promising as expected due to disagreements over the green economy, for example, which was a central element of the conference, and because it did not give so much emphasis to elements such as EIA and SEA.

In spite of these considerations, it is important to note that, as posed by David Evans (2018), the concept of "sustainable consumption" was retaken at Rio+20, which had its first debates in Rio'92, as a means to broaden the discussion about the challenges of impacts on the environment driven by the capitalist economic model. From this perspective, the author emphasizes

that it is not necessary to change only production and consumption but all the economic, political, cultural, and social processes that permeate this dynamic in search of a sustainable systematization.

To increase the importance of the sustainability debate, in the 2000s, within the UN, member states defined eight Millennium Goals as an attempt to discuss, mitigate, and adapt to contemporary challenges. These objectives were mainly based on the attempt to eradicate poverty, improve health conditions, promote equality, and ensure sustainability in relation to the environment. It is noted that the configuration of such objectives function as an integrated system in which each element depends on the other to guarantee its success (United Nations 2015).

Already in the year 2015, in a published report, the UN notes that many advances have been made, however, other problems continue or have even been aggravated as the issue of social and economic inequality, and the environmental issues that have become increasingly prominent in recent years.

For these reasons, in 2015, the UN launched 17 goals known as "Sustainable Development Goals," highlighting previously agreed goals and expanding their scope, placing the role of sustainability as central to ensuring change, such as the importance of responsible consumption, as well as food and energy security for social sustainability and ensuring action against global environmental and climate change.

It should be stressed that, in this sense, sustainability does not only appear in relation to the environment but also in consideration of economics and policy to allow the promotion of development and growth in a sustainable way. These elements highlight again the relationship between society and nature as the mode of production and development affects the environment and vice versa (Almeida 1972; Bates 1969; Campbell and Wade 1972).

Analyzing the centrality of the problem mentioned here is essential for trying to make new strategies for facing it. Thus, the role of sustainability and the quest for sustainable development are very important for the survival of our species through the Anthropocene (Tolba 1982; Giddens 2009), as such measures adopted in the political, social, and productive process as a whole would be essential for promoting the mitigation of problems and, especially, the preparation to adapt to changes already under way and also to those that will still come.

Conclusions

The discussion connecting topics such as the Anthropocene and Sustainable Development has brought to light debates as this one are essential to the understanding of issues so present in the everyday life of contemporary societies. This is mainly due to the fact the twenty-first century faces challenges when it comes to maintenance and survival of the planet, as today's world is presented with threats as severe as climatic disasters and environmental changes, which are, as a whole, indubitable.

As put by the authors studied, these transformations have occurred on a large and deep scale in a relatively short period of time, dating back roughly to the period after the Industrial Revolution, that is, just over 150 years.

It is noted that the risks have deepened, mainly by the influences of human action on the environment. However, it is important to point out that this influence is part of a very broad process, involving different spheres and areas, that is, the political action linked to the mode of production and consumption as an economic model based on the supposition that the resources would be unlimited; in addition, there is the preconception of social patterns and habits linked to the idea of consumption as happiness and satisfaction. It is in this sense that not only the analysis of what is happening must take place in an integrated way, but also the search for solutions.

Given the available information, this article concludes by highlighting the importance of the relationship between the natural sciences and the human and social sciences, so the Anthropocene should not be treated only as a chemical concept on greenhouse gas emissions and their consequences in the global environmental changes but still as a systemic crisis, in which the observation of society as a whole is fundamental to broaden its understanding. This observation can be corroborated with the graphs

on "The Great Acceleration" adapted by Steffen in 2010, relating the social and planetary trends according to the different regions and countries (with their particularities).

Another consideration is the construction of the concepts of sustainability and sustainable development. The authors who discuss the Anthropocene make it clear that the fact that the planet is reaching its limits represents a situation so complex that it is no longer possible to reverse the whole problem and therefore the search for alternatives based on adaptation is extremely essential (Janssen and Ostrom 2006; Giddens 2009). And it is in this sense that sustainability is central to determining Humankind's ability to adapt to changes to survive the Anthropocene. It is noted that the term ascended from the 1970s and went through different phases of discussion, sometimes being expanded and in others "erased" with the idea that technology could solve any planetary limitation.

Finally, the subject discussed in this entry is of great relevance for the contemporary debate. Besides, it makes an attempt to link sustainable development to the concept of anthropocene.

Cross-References

- ▶ Conscious Consumption and Sustainable Development
- ▶ Environmental Impacts and Sustainable Development
- ▶ Reflective Actions for Sustainable Development
- ▶ Strategic Thinking and Sustainable Development
- ▶ Sustainability Challenges
- ▶ Sustainability Mindset
- ▶ Sustainable Development Goals

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Applied Theatre

▶ Arts-Based Approaches for Sustainability

Appropriation of Funding for Sustainability in Higher Education

▶ Budgeting for Sustainability in Higher Education

Areas of Sustainability

▶ Sustainability Domains in Higher Education

Art for Well-Being

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▶ Art-Based Teaching on Sustainable Development

Art-Based Teaching on Sustainable Development

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Synonyms

Art for well-being; Art pedagogy for health; Art pedagogy for sustainability; Art therapy; Arts-based teaching; Environmental aesthetics; Environmental art

Definition

Art-based teaching for sustainable development encompass a range of philosophical stances and practices which are deployed intentionally for educational outcomes relevant to sustainability and sustainability development. Such teaching philosophies and practices are typically deployed because of the form of knowledge and knowing they promote, which can be described as experiential, integrative, holistic, complex, anticipatory, and passionate.

Introduction

The connections between art, art-making, education, and responsibility in relation to the wider natural and social world have been given increasing attention over the last 30 years. For example, there have been a variety of journal special issues dedicated to art, education, and ecology (Krug 1997), social justice and social change (Bolin 1999), community and responsibility (Carpenter 2004), ecology and responsibility (Stout 2007), health and well-being (Haywood-Rolling 2017), and human rights (Kraehe 2017). Such a rise has been linked to trends in the human search for meaning and significance among (and resistance against) globalization, domination of market forces, and an increasingly complex and chaotic environment (Taylor and Ladkin 2009).

The connections between art, education, and sustainable development have also been recognized in various UNESCO initiatives such as the Road Map for Arts Education (UNESCO 2006) and The Seoul Agenda: Goals for the Development of Arts Education (UNESCO 2010). The Road Map, for example, asserted the role of arts education in (1) upholding the rights of individuals to participate in education and culture; (2) developing a wide range of capabilities including "creativity and initiative, a fertile imagination, emotional intelligence and a moral "compass," a capacity for critical reflection, a sense of autonomy, and freedom of thought and action" (UNESCO 2006: 4); (3) enhancing systems of education; and (4) promoting cultural diversity.

Similarly, the Seoul Agenda echoed these sentiments but was perhaps more explicitly linked to sustainable development, articulating a commitment to "apply arts education principles and practices to

contribute to resolving the social and cultural challenges facing today's world" (UNESCO 2010 p. 8). UNESCO's International Arts Education Week has since explicitly promoted the connectedness of art, education, and sustainable development through the themes of "Arts for Peace" and "Arts Education for Sustainable Development." The role of art and art-based teaching methods in sustainable development is therefore increasingly recognized as significant and especially so in the influential spaces of higher education.

Within this wider landscape of context, this chapter therefore explores and exemplifies the role of art-based teaching in the context of sustainable development in higher education and maps out some suggested future developments. It does this by articulating the nature of art-based knowledge, knowing and outcomes in the context of higher education, and then exploring the ways in which these aspects manifest and are implemented in higher education practice across the globe.

Art-Based Knowledge, Knowing, and Outcomes

Art-based teaching does not draw solely on the epistemology of logic and rationality, the conceptualization of knowledge, and knowing which has dominated many forms of learning, teaching, and research in the twentieth century (Taylor and Ladkin 2009). Instead, art-based teaching draws from an epistemology where knowledge and knowing are derived from the senses or sensual knowing. This is the realm of *aesthetics* and *aesthetic inquiry*, a realm of inquiry attuned to the reconciliation of the sensual and rational dimensions of human experience (Schiller 1910) or the integration of thinking, feeling, and doing (Dewey 1934). Within this realm, art "provides a grasp of new affinities and contrasts, cuts across worn categories to yield new organization, new visions of the worlds we live in" (Goodman 1976: p. 5). Or, as Shrivastava et al. (2012, p 28) explain "art yields an opportunity for every individual human being to learn more about their intense emotional life. . . to create a harmonious and balanced life for people". As such, it is intimately inclusive.

Understood in this way, and within the context of higher education, art – as a particular form of knowledge and knowing – is a highly relevant and generative space for complex, higher-order learning often characterizing sustainable development. Indeed, art has been understood as a counter-response to an overreliance on cognitive understanding, toward a more "holistic, physical and emotional engagement with sustainability issues" (Shrivastava 2010, p 443). As such, art-based teaching can be seen as a pathway to facilitate a reorientation from external spaces to internal spaces of the human mind and emotions (ibid). Specifically, such a reorientation has been described to evoke a more *passionate* (rather than *dis*passionate) relationship with nature, thereby framing any sustainable development (or broader) action-taking. In this way, "art offers an antidote to the mental and emotional pollution of commercialism, which eventually lead to the toxification of air, land, water, and the excessive consumption of carbon" (Shrivastava 2012: 32–33).

From this perspective, it is argued that art can evoke the "intense emotional and practical experiences" which are at the heart of "passion and emotion (and not cognitive understanding alone) that lies at the core of behavioural changes" (Shrivastava et al. 2012: 27). Drawing from such a perspective, art-based teaching engages a wide range of the factors linked to deeper forms of learning relevant to sustainable development. These include, for example, developing conceptual and metaphoric perspectives, visualizing connections within broader conceptual frameworks, and actively reflecting in contexts of experiential learning (Warburton 2003).

Similarly, art and art-making are recognized as having a particularly efficacious role in promoting affective learning outcomes, such as (1) generating personal awareness in relation to sustainable development, (2) promoting sets of values aligned to responsibility and sustainable development, and (3) initiating and mobilizing action in relation to sustainable development (Reid et al. 2006; Shephard 2008; Sauerwein et al. 2017). In this way, approaches to art-based teaching aspire to evoke more holistic and integrated understandings

(such as people-planet-prosperity) which lead to action-taking. The next section identifies ways in which such underpinnings manifest in practice.

Art-Making Approaches and Processes

Art, outside of the context of sustainable development and higher education, has been integrated into educational settings in a diversity of ways, described by Bresler (1995) as four models: *coequal* (where art is *part* of the learning focus, e.g., learning how to draw landscapes as well as learning how to plot maps), *subservient* (where art is positioned as *enabling* the learning of *other* topics, e.g., learning drawing in order to plot maps), *affective* (where art enables learning and self-efficacy, e.g., learning how to draw to build confidence in learning how to plot maps), and *social integration* (where art facilitates the cultural celebration of communities, e.g., holding a community event where the community learn how to draw to map out the design of a new play area). There are subtle differences here, but they illustrate the intentions of the art activity. However, such subtleties are also evident in the context of art-based teaching for sustainable development in higher education, and each of these can be found in practice. To help exemplify such practices in higher education, Taylor and Ladkin's (2009) more contemporary model provides a pragmatic framework to plot the variety of art-based processes which can be adopted in the context of higher education: skills transfer, projective technique, illustration of essence, and making. Each of these is now discussed.

Skills Transfer

Art-based teaching can facilitate the development of artistic skills which are useful in education for sustainability settings, as the competences developed through art-based teaching reflect future-oriented higher education competencies, including dealing with complexity and ambiguity, systemic thinking, holistic thinking, anticipatory thinking, and for engaging communication and participation (Sandri 2013). Examples of art-based teaching for skills transfer can include (1) the use of art exhibitions coupled with art appreciation to develop the emotional and spiritual skills important for the holistic and interrelated capabilities relevant to sustainable development and (2) the use of art training with medical students to develop their visualization and observational capacities to enhance diagnosis and physical examination processes (Shrivastava 2010). Similarly, van Boeckel (2017) explores "lines on the hand" practices, involving the imaginative task of connecting the wrinkles on one's hands to personal histories of time, place, and people, to support a greater sense of connectedness, thereby enhancing sense of well-being. Such practices have been found to be efficacious in generating new skills, in addition to broader self-awareness and connectedness to land and its coinhabitants.

Projective Technique

Approaches to art-based teaching which generate artful artefacts encourage and facilitate the accessing and sense-making of inner experience, thoughts, feelings, and actions. Examples of art-based teaching include (1) the use of painting to represent strategic thinking and new concepts in the context of integrated science, technology, and arts programs, (2) the use of painting in order to improve the health and well-being of patients in health and social care settings (Shrivastava et al. 2012), and (3) the use of clay sculptures to explore and represent "little me," or internal representations of self in relation to wider landscapes, as a platform for insight and possibilities of other expressions (van Boeckel 2017). Although such practices may be familiar in some arts-based pedagogical practices, they are still uncommon across other disciplines and may well be interpreted and unorthodox in some disciplines.

The use of photography has also been used in education for sustainable development in higher education, as it offers an alternative way to access thoughts and feelings that might not be accessible through spoken or written word (Scott 2014). Lin and Li (2017), for example, used photography to help higher education students explicate their conceptions of oceanic sustainability. They identified (1) a continued preoccupation with environmental rather than integrated social, economic and

environmental dimensions, (2) ambiguity around who should take responsibility for life-wide issues, and (3) that pedagogical approaches which integrated arts, science, and community, were linked to "a more balanced, action-motivated conception of sustainability" (Lin and Li 2017: 554). Such findings also highlighted the role of art-making practices, such as photography, in "revealing" the aspects of thoughts and feelings which are not necessarily socially desirable, such as own understandings about one's own positioning or personal responsibility in the world.

Illustration of Essence

Art-based teaching can promote the drilling to the "core" of "a concept, situation, or tacit knowledge in a particular way, revealing depths and connections that more propositional and linear developmental orientations cannot" (Taylor and Ladkin 2009: 56). Examples include (1) the use of "paintings, drawings and metaphors that bring life to [participants'] vision of sustainability" (Ivanaj et al. 2014: 23) in personal and professional lives, and (2) the use of meaningful metaphors and images to capture the essence of new ways of working which promote health and wellness and how to achieve it (Wall et al. 2017). Such processes help develop new frames (Wall 2016a, b) to help clarify the personal and group vision for their sustainability action and facilitate the sharing of the vision with others, to then, in turn, refine and develop action within a wider community (Wall et al. 2017). Similarly, the use of striking imagery, such as the conditions of battery chickens, has been used to intentionally generate affective responses in higher education learning settings (Wall et al. 2018, forthcoming).

Disciplinary differences in pedagogical traditions may mean that some of these practices (such as museum visits) are not necessarily adopted widely beyond fields allied to the arts. However, other practices which illustrate an essence of some kind are likely to be much more widely adopted across the fields in higher education practice but may well appear as part of examples, anecdotes, stories, short case studies, dilemmas, or experiments, which are used as pedagogical devices. Such devices embody aesthetic qualities which amplify and highlight certain aspects and dimensions more than others and therefore embody particular perspectives or angles, have boundaries, evoke and provoke affective responses, and are intentionally packaged in ways to make a pedagogical point or series of them.

Making

The process of creating art and artful artefacts can "foster a deeper experience of personal presence and connection, which can serve as a healing process. . . [for those] who may so often experience their lives as fragmented and disconnected" (Taylor and Ladkin 2009: 66). Indeed, there has been increasing interest in the therapeutic applications of expressive arts (and art therapy in particular) to foster human healing and growth (Shrivastava et al. 2012). These practices can include pedagogic activities, such as "wildpainting" (van Boeckel 2017), located within natural environments coupled with contemplative practices such as meditation to amplify sensory connection beyond the self (Flowers et al. 2014). In articulating how to design such art-based teaching practices, van Boeckel (2017) suggests that the key features of art-based environmental education practices and activities include:

- Bring greater awareness to personal observations – so when students engage in artful activity, such as illustrating land, they are able to notice fine details, for example, the specifics of how grass and rock interrelate in nature.
- Generate greater sensitivity to live processes happening in nature (e.g., growth and decay) – so when students engage in artful activity, such as illustrating ladybirds on strands of grass, they are able to notice the finer details of how, for example, the ladybird rests, slides down, and inhabits a blade of grass.
- Develop alternative ways of viewing the environment – finding new ideas and perspectives from becoming more aware of the minutiae in the environment and the associated patterns of interconnectedness in nature.
- Test the scale of the environment and the limits of humans – where one becomes aware of

one's positions in relation to wider environments, such as a mountain or an ocean, and notices the impacts of that on the nuanced details around them, e.g., how the water touches and forcibly moves the sand, soil, and the blade of grass on which a lady bird sits.

In order to work toward these features, the structure of art-based teaching practices for sustainable development has been described as a "dramatic" process based around insight, and the integration of that insight, into the pedagogical activity and wider learning program. van Boeckel (2017) describes this process as relating to three main stages:

- *Before: exposition* – this stage is about setting of the scene, the context, and the characters, as understood in the learner's ordinary world. For example, this might include framing the pedagogical activities in relation to the higher education program on which the students are engaged: in relation to a "business planning" course, a visit to the museum might be explained in terms of building appreciation of historical events and emotion. Then the task might be that students adopt a role of a character in one of the pieces of art which embody a conflict.
- *During: rising action/climax/falling action* – this is the process of new awareness, conflicts, tension, and discomfort, as the learner (and facilitator) travels through the art-making process. In relation to imagining oneself as a character in a painting, the activity might involve appreciating and empathizing with the character in the piece (rising action), and noticing what happens when they become part of a conflict in the piece (climax), followed by a reflective period of noting and making sense of what was noticed (falling action).
- *After: resolution* – this is the final stage where the learner has completed the art-making process and presents (in some way) the outcomes of their art-making, integrating some elements of closure. In the activity above, the final activity might be sharing one's thoughts as another layer of sensemaking and then consolidating some insights in relation to what one might need to do, which may of course include spending more time in the museum as a source of provocation and insight.

Participative Art-Based Teaching Approaches and Processes

Within the context of higher education, art and art-making processes have been utilized with multi-stakeholder groupings for the dual political goals of education and change, across a diverse range of sustainable development goals such as promoting health and well-being, gender equality, and environmental impact (Kagan 2011). Such participatory approaches have developed a variety of features and outcomes including (1) prompting and facilitating the exchange of ideas, (2) prompting and facilitating dialogue amongst multiple stakeholders, (3) building awareness and understanding of information and issues, (4) generating dissonance and concern, and (5) building a sense of place (Marks et al. 2016; Rossetti and Wall 2017).

Toward these aspirations and outcomes, participatory art-based teaching in higher education often promotes the capture of, and dialogue around, multiple and diverse personal and disciplinary perspectives through visual imagery (Haley et al. 2017). Although there are potentially various ethical issues involved, such as using one (vulnerable) person's effort for some other (powerful) person's benefit, there are many practices which can enable positive outcomes for those considered to be vulnerable, or for all involved. For example, in relation to critical photographic practices, a number of approaches have been developed (Purcell 2009) such as:

- Photo-elicitation – to capture and then explore particular behaviors in community settings, in relation to identities, ethnicities, or in terms of memory and regaining sense of time and place. For example, the utilization of photographs with older persons or people experiencing dementia, to relocate a more familiar time and place.

- Photo-novella – to "empower" members of the community to capture their own stories which enables them to explore the meaning and significance of their own stories. For example, enabling a deprived community to capture what it means and feels like to live in a particular place or space.
- Photo-voice – where people (who may be considered vulnerable in some way) are given the equipment to record and reflect the day to day experiences, challenges, and tensions to a wider audience. For example, one practice is to give those who are experiencing poverty in some form a camera to capture their experiences from their own lived perspective. This might then be used in a wider setting where community stakeholders such as business owners and government officials respond to what is presented (e.g., The Poverty Commission in Scotland and England).

Participatory art-based practices can also be integrated into much larger-scale activities, linked to multiple political outcomes. For example, The Womanifesto Residency Programme in Thailand aimed to connect tradition and natural resources, utilizing art and artists to stimulate dialogue and debate. The program involved a range of art workshops and public art collaborations involving schools, colleges, universities, and a range of communities including farmers and artisans (ASEF 2012). Although the program developed art-making processes, it also tackled gender inequalities by positioning women as creators and collaborators (ibid). Similarly, the "Art Activism"-based initiative in Singapore brings together artists, activists, scholars, and students as a platform for art collaborations at the grassroots level in relation to sustainability. The format included exhibitions, public dialogue, and publications and involved professionals from various sectors including the arts, media, university, social entrepreneurs, environmentalists, and philanthropists (ibid).

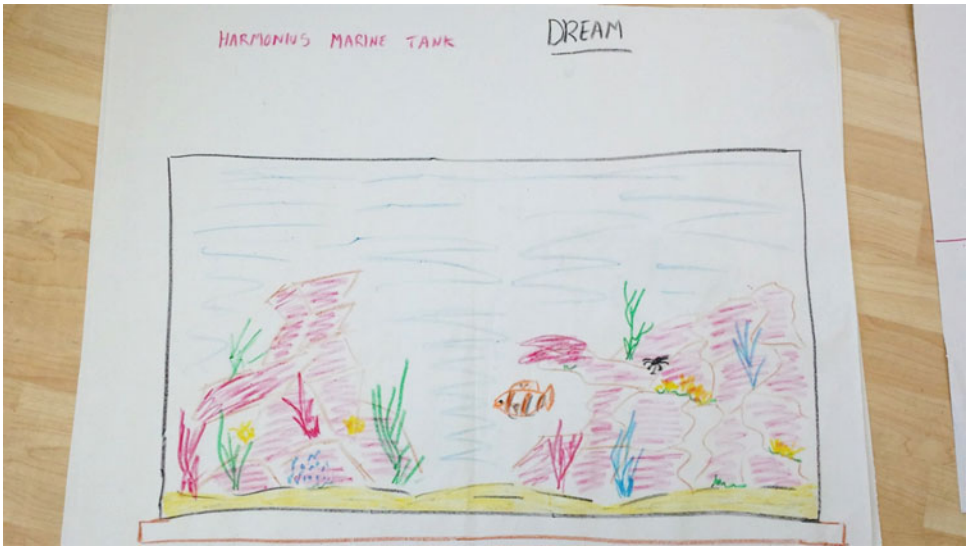
More recently, art-based practices have also been combined with appreciative inquiry processes which aim to establish and maintain a positive psychological state of participants, to facilitate generative change and transition. Through such processes, diverse groups come together and utilize rich visual metaphor and imagery to (1) appreciate current achievements, (2) envision a sustainable and desirable future state, and (3) agree actions to achieve that future state (Wall et al. 2017). For example, participants use visual metaphors and imagery to explore the following questions:

- "Discovery": *When did we work well together?*
- "Dreaming": *What would be the ideal of us working well together look like?*
- "Designing": *What do we need to prioritize to make this happen?*

Wall et al. (2017) found that in exploring these questions, participants envisioned a new organizational culture which prioritized collective well-being and connection to nature. This was captured through imagery including *smiling faces*, *plants*, *clouds*, *sky*, *sunshine*, *trees*, *wind surfing*, *fish*, *ducks*, *sea life*, *friends/family/community*, *and house/home*. An example of a participant's drawing in the "dreaming" stage is depicted in Fig. 1 below. It importantly illustrates the sense of "dreamlike" freedom that such a collaborative task enabled and the embodiment of aesthetic fuzziness, color, and metaphoric meaning-making that is important to the form of aesthetic knowing central to art-based teaching.

Conclusion and Future Directions

Though the relationship between art, responsibility, and education has developed over the last 30 years, there are still controversial undertones. For example, there are perspectives which want to keep the inherent value of art as sacred (i.e., art for art's sake) and do not approve of the "subservient" role of art for other functionalities (e.g., "art for earth's sake," Reid et al. 2006; Smilan 2016). Similarly, there are ongoing tensions in educational contexts when art and artefacts are subject to any form of assessment (Haanstra and Schönau 2007). Yet it seems, according to the evidence



Art-Based Teaching on Sustainable Development, Fig. 1 An example of participant drawing in the "dreaming" phase. (Source: Wall et al. 2017: 138)

outlined in this chapter, that such controversies are not necessarily stopping the pace at which art-based teaching is being utilizing in the context of sustainable development (Gunn 2016).

Future directions of art-based teaching practice and research will continue to emerge which will explicitly combine and integrate embodied understandings of sustainable development, especially in the context of science, technology, engineering, and mathematics higher education (STEM). There has been a move to integrate art into this STEM agenda, and the new acronym has expanded to include the A of Art, to create the STEAM agenda. These emerging trends will continue to amplify and expand the STEAM agenda in higher education and will thereby create new and innovative pedagogical forms with sustainable development, change, and transformation as driving principles (Payton et al. 2017).

Cross-References

- ▶ Arts-Based Approaches for Sustainability
- ▶ Reflective Practice for Sustainable Development
- ▶ Storytelling for Sustainable Development

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Artful Inquiry

► Arts-Based Approaches for Sustainability

Arts-Based Approaches for Sustainability

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Synonyms

Aesthetics; Aesthetic inquiry; Applied theatre; Artful inquiry; Creative writing; Drama; Expressive arts; Performing arts; Storytelling

Introduction

The arts encompass a broad and diverse landscape of interrelated creative practices and professions, including performance arts (including music, dance, drama, and theatre), literary arts (including literature, story, and poetry), and the visual arts (including painting, design, film) (see UNESCO 2006). They have been explicitly linked to sustainable development in higher education at a global level through UNESCO's Road Map for Arts Education (UNESCO 2006) and The Seoul Agenda: Goals for the Development of Arts Education (UNESCO 2010). Specifically, the arts have been deployed to promoting human rights, enhancing education, promoting cultural diversity, enhancing well-being, and, most broadly, "resolving the social and cultural challenges facing today's world" (UNESCO 2010: 8).

Such recognition highlights the distinctive role of arts-based approaches to promote sustainability and sustainable development, in terms of (1) tapping into "an optimal level of aroused attention," "somewhere between apathy and wild excitement" (Bruner 1960: 72), and (2) tapping into an ability to "break with what is supposedly fixed and finished... [so] a person may become freed to glimpse what might be" (Greene 1995: 19). Such capabilities highlight the role of imagination to recast and therefore reconfigure and transform the world. Arts-based approaches to sustainability distinctively draw from forms of knowledge and knowing which are derived from the senses or aesthetics and aesthetic inquiry (Taylor and Ladkin 2009). In doing so, some have argued that the arts "offers an antidote to the mental and emotional pollution of commercialism, which eventually lead to the toxification of air, land, water, and the excessive consumption of carbon" (Shrivastava et al. 2012: 32–33, Shrivastava 2012: 635).

More specifically in higher education, the arts are recognized as promoting highly relevant and generative spaces for complex, higher-order learning and change work that includes (1) systemic/holistic thinking, (2) the integration of multiple and different perspectives, and (3) the articulation and development of attitudes and values (Svanström et al. 2008). Similarly, the arts can also be linked to affective learning outcomes which are particularly important in relation to sustainable development work, such as (1) generating personal awareness in relation to sustainable development, (2) promoting sets of values aligned to responsibility and sustainable development, and (3) initiating and mobilizing action in relation to sustainable development (Shephard 2008). This chapter focuses on three significant arts realms which have demonstrated important contributions to different aspects of sustainable development: expressive writing, drama, and applied theatre (also see ▶ "Art-Based Teaching on Sustainable Development" which covers the visual arts and the ▶ "Storytelling for Sustainable Development" chapter).

Expressive Writing

Expressive writing has been utilized in higher education in a number of sustainable development areas including health and well-being, social change, and environmental education. In terms of health and well-being, expressive writing for sustainable development can include reflective writing, creative writing for therapeutic practices, bibliotherapy, poetry therapy, and the medical humanities (Bolton 2011). It can include a wide range of practices including free writing, listing, deep attention description, narrative and stories, image and metaphor, (fictional) dialogue, journaling, diaries, blogging, zine writing, writing/use of fiction, writing/use of poetry, autobiography, potted histories of self, letters to self or others, future states, and writing/use of comics (Ross 2012).

Expressive writing practices have, for some time, been linked to a strengthened immune system, various medical markers of health such as blood pressure, reduced indicators of stress, longer-term mood changes, and ability to deal with social and work life (Pennebaker 1997). Likened to other forms of therapy, expressive writing functions in the following ways:

1. Exploration of narratives of experience from different perspectives
2. Reflexive clarification of values, principles, ethics, feelings, and identity

3. Critical examination of metaphors in daily use
4. Metaphor "games" to express the otherwise inexpressible
5. Imaginative acute observation and description (Bolton and Ihanus 2011: 168)

As a way of encouraging deep learning through reflection and experiential learning, expressive writing processes are likely to be personal, where "any issue can be shared relatively fearlessly with a piece of paper. . . [it] can be ripped up, burned, flushed away; creating it will have helped without rereading" (Bolton 2011: 22), but can also be used in group settings to promote dialogue in relation to the processes above. Although referring to the process of poetry therapy, Mazza's (2017) process model has wider relevance to integrating the use of expressive writing for health and well-being outcomes. Mazza (2017: 17) proposes three key stages:

1. Receptive/prescriptive – this stage introduces and frames writing into the setting.
2. Expressive/creative – this stage utilizes the writing activity/practice.
3. Symbolic/ceremonial – this stage draws on and makes sense of the situation using metaphors, rituals, and narrative.

In the context of higher education in health and medical fields, the most common form of creative writing is journaling and reflective writing for experiential professional development, but the creative writing of stories and poems is also used to promote humanistic and empathy learning outcomes alongside clinical and technical training (Cowen et al. 2016). In contrast, poetry and narrative writing may also be used in the context of environmental education, but they are typically (1) more explicitly related to exploring the student's own relationship to others and the wider, natural world and (2) will oftentimes be located within natural environments as a fundamental part of the exploratory experience (van Boeckel 2013).

Similar integrations of poetry can be found in business management fields, where poetry is used as part of wider pedagogic apparatus to reorient education toward holistic, systemic, and responsible learning outcomes (Reason 2007). For example, haiku (a form of poem which embodies a close human-environment connection) has been used to promote and capture wider ecological and environmental learning (Reason 2007: 37–38):

> A seed grows.
> Water gives it strength.
> The Earth moves (Linda Farrow).

> Water drop on leaf
> A tear rolls down for times lost
> And new beginnings (Ruth Townsley).

> A bramble catches
> My ungainly fall;
> Thank you, I say (Ian Nicholson).

Expressive writing is also used in action research pedagogies in higher education to facilitate wider-scale change where collaboration, responsibility, and ethics are important. For example, as part of a collaborative change project, the writing of, sharing of, and reflection on stories and metaphors have been employed to explore and mobilize organizational change in higher education with (1) positive psychological states and (2) connectedness and sense of belonging to others and wider natural environments (Rossetti and Wall 2017; Wall et al. 2017). In addition, creative narrative accounts have been used to challenge and disrupt wider narratives about education, learning, and students, for example, (1) using humor and experimental creative writing to reposition "student as customers" as interconnected responsible practitioners (Wall 2016a, b; Wall and Jarvis 2015) and (2) using narrative accounts to challenge how humans relate to animals and other sustainability issues (Wall et al. 2018, forthcoming).

Drama

The delineations between drama and applied theatre are not firmly fixed, but an extreme simplification is that (a) drama is based on improvised interaction in a fictional context without given lines or external audience, and (b) applied theatre is usually created and devised by the participants and performed to an audience. In terms of the first of these areas, drama processes have been

articulated as an effective way to generate new insight into difficult issues, for example, in relation to holistic thinking, integration of multiple perspectives, and the development of attitudes and values (Österlind 2012; Pässilä et al. 2017).

This effectiveness seems to be particularly important given the content of sustainable development can be emotionally (as well as physically) challenging to both teachers and students (Wall et al. 2018, forthcoming). Specifically, drama implicates learning through distinctively embodied and verbal interactions and reflections, where people can experience and feel a variety of different perspectives. Here, people are enabled to explore the perspectives and their respective consequences, tensions, and dilemmas in fictive situations to be dealt with on the spot, at a "real-life pace." In a sense, drama work provides an authentic but safe space to embody perspectives and explore them (Wall et al. 2018, forthcoming; Österlind 2012).

One of the integral processes of drama is role-play, which is now often used in a wider educational for sustainable development context (Blanchard and Buchs 2015; Chen and Martin 2015). The application of role-play transcends higher education disciplines and includes economics (Alden 1999), business and management (Paschall and Wüstenhagen 2012), geography (Schnurr et al. 2014), engineering (Edvardsson Björnberg et al. 2015), and biology (Oliver 2016). It has therefore gained widespread traction in higher education to work toward sustainability and sustainable development outcomes.

Role-play has been found to be comparatively more effective than other learning activities in the context of education for sustainable development (Ballantyne and Packer 2007), across a variety of settings such as a postgraduate program in engineering for sustainable development, where role-play "clearly had the most impact" (Cruickshank and Fenner 2012: 259). More recently, Gordon and Thomas (2016) highlight that although role-play can be resource-intensive, demanding, and time-consuming, the results are significant and that "the learning sticks" (ibid: 14), that is, the learning itself has a longevity beyond the role-play intervention.

Interactive drama is an alternative to role-play and has also been utilized in the context of higher education for sustainable development. It is a process where the characters and storyline are not predetermined but emergent and determined by the participants. Boggs et al. (2007) emphasize that such interactive approaches to drama enable students to be involved in situations that are both engaging and related to the theoretical aspects of their academic work and personal experiences.

Such drama approaches are particularly effective in developing connectedness, in terms of others but also to other species and the planet (Wall et al. 2017, 2018, forthcoming), especially because "the cornerstone of theatrical communication is empathy" (Etherton and Prentki 2006: 146). In their research, Davis and Tarrant (2014) used drama techniques to investigate how to foster connections between human and environment and combine science-based, fictional, and experiential components. They found that a combination of experiences in the natural environment (including drama experiences such as meeting characters in nature), and drama work in the classroom, was especially effective. In particular, they found that when the students worked in roles, the learning became personally integrated and deepened. Although some dilemmas continue to persist, Davis and Tarrant argue such an integrated approach to deploying drama techniques in higher education is "scientific and rigorous, and also connected and empathetic" (2014: 194).

Applied Theatre

Applied theatre encompasses many forms of theatre with an educational aim to raise awareness and support societal change. Applied theatre is signified by going beyond the norms of classical theatre in terms of audience (reaching out to people where they are), place (outside ordinary theatre venues), and performers (other than just professional actors). The plays are usually created together with, or in dialogue with, particular groups who are the target for the awareness raising or change initiative (Maeve and Pentergast 2014). As applied theatre is an embodied practice, it is an effective way to "examine post-human subjectivity in relation with other beings living

on the Earth, as well as human-made things and technology" (Aaltonen 2015: 420). In other words, it can help explore situations from many alternative perspectives which go beyond thinking as a human, for human gain, in order to perpetuate human domination over the Earth and its cohabitants (Wall et al. 2018, forthcoming).

Applied theatre is used widely to work with sustainability issues such as health (e.g., HIV/AIDS), environment, poverty, corruption, conflict, and violence (Barnes 2014). As applied theatre is often created and delivered closely with communities, it may not be the most common place for it to be located within a higher education setting. However, higher education organizations do (co)facilitate applied theatre activity with local communities in their settings for the purposes of sustainable development. For example, at Tainan University in Taiwan, students work together with community members in applied theatre processes, on local issues related to climate change, globalization, and the transition from an agricultural to industrial and postindustrial society (Wang 2017). Similarly, street theatre has been used in Canada to engage higher education communities in discussions and dialogue about sustainability (Wright et al. 2013). Such creative engagements between and among communities have also been used in a transdisciplinary sustainability education model that integrates science, the arts, and community, where theatre was one of the ways in which higher education students "developed their ability to connect academic domains of knowledge and creatively address sustainability challenges" (Clark and Button 2011: 41).

More specifically, Theatre of the Oppressed (Boal 1979) is one of the more commonly used theatre forms under the umbrella of applied theatre, and Forum Theatre, as a specific technique, is used to explore sustainable futures in many settings. Such forms enhance "strong sustainability" (Räthzel and Uzzell 2009) as it deepens self-reflection and self-transformation in the context of the wider power structures of society and thus strengthens abilities to act in society. Forum Theatre and other forms of drama work are also used in nurse education to promote openness, dialogue, and personal reflection and to support students to develop critical thinking (Arveklev et al. 2015). Similar processes such as Forum Play are used in the training of teachers, partly to identify and transform oppressive educational practices (Österlind 2011).

As these applied theatre practices encourage collaborations to break down divisions and boundaries, they can also work to help integrate disciplinary boundaries within higher education organizations, especially between arts and sciences (Clark and Button 2010). In this way, applied theatre can promote "creative trespassers" (Bedetti 2015: 2) who cross disciplinary boundaries, which means that dramatic play can be one of the few spaces or places where disciplines can meet. In her study of the integration of dramatic arts into a university general education course, Bedetti (2015) found that collaborative playwriting and theatre work could create "a more holistic and integrative approach to higher education" (ibid: 9) and that "deeper learning" could be acquired, where students learned to create, rather than to just hold, information. Similarly, in a collaborative, intercultural project based on Nikolai Gogol's 1836 play "The Government Inspector," different groups in various places around the world staged a production to address economic unsustainability and corruption. Higher education organizations collaborated with various organizations with the hope for "trans-structural flows in between organizations" (Eliason Bjurström 2012: 21). It was therefore an approach that mobilized the efforts and energies across the globe toward the common goal of a more sustainable future.

Conclusion and Future Directions

The contributions of arts-based approaches for sustainability in higher education emanate from their distinctive ways of knowledge and knowing which, the evidence indicates, demand affective responses leading to multiple transformative effects. The three significant arts-based approaches in this chapter included expressive writing (which, e.g., tapped into therapeutic processes to enhance well-being and health), drama (which, e.g., tapped into the creative possibilities of exploring difficult and complex perspectives of

sustainable development), and applied theatre (which, e.g., tapped into the creative possibilities of collaborative working to break down divisions and barriers relevant to health and well-being). A common theme is that the arts provide an accessible way for people (students, tutors, business people, etc.) to explore the complexities of the multiple facets of sustainable development.

Future directions of practice and research will include the more widespread use of arts to (1) disrupt the current power flows in society to enable more sustainable approaches to development, as well as to (2) help foster greater interdisciplinary to tackle such issues. In terms of the first of these, the arts will continue to help problematize and create new ways of making sense of place, space, and connectedness to these, especially under the conditions of digital life. This is likely to involve the generation of new organic metaphors, perhaps derived from the emerging post-human debate, to help reformulate how we organize, make sense of, and judge communities (including educational ones), sustainable development itself, what it means to be human (or post-human), and the consequences of these (Sauerwein et al. 2017).

The second direction will involve the arts combining in new ways (again mediated by digital life) to integrate embodied understandings of sustainable development. In higher education, this is likely to be seen in the context of extending and expanding the STEM agenda (science, technology, engineering, and mathematics) toward a STE**A**M agenda where the unique and distinctive contribution of the arts becomes more prominent (Payton et al. 2017). The extent to which each of these disciplines will become equal is unlikely or at least unknown but will continue to be set against a trend toward employing greater interdisciplinary that is required to tackle the complex issues of sustainable development.

Cross-References

- ▶ Art-Based Teaching on Sustainable Development
- ▶ Reflective Practice for Sustainable Development
- ▶ Storytelling for Sustainable Development

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Arts-Based Teaching

► Art-Based Teaching on Sustainable Development

Assessment for Learning on Sustainable Development

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Definition

In this entry, assessment for learning on sustainable development is defined as a systematic approach (or process) geared toward facilitating learning and providing comprehensive evidence of learners' knowledge, skills, values, and attitudes related to sustainable development.

Introduction

The concept of sustainable development and its underlying principles has been introduced, defined, and actively promoted since 1972. One key aim of sustainable development is securing a better future for present and future generations. Education is seen as the means through which sustainable development can be achieved. If the mandate of achieving a sustainable future is to be fulfilled through education, appropriate teaching, learning, and assessment strategies that are compatible with the goals of sustainable development are needed. In line with this, therefore, is a recent focus on the reorientation of the education system away from assessment practices that mainly target students' knowledge, to those which also consider skills, values, attitudes, and behaviors. The use of appropriate teaching strategies should be at all levels of the educational system, including higher education. Higher education particularly plays a critical role in achieving sustainability because of its direct link to students who will become leaders in the future. According to UNESCO (2005:4):

> Traditionally, literacy, numeracy, and disciplinary knowledge are assessed using standardized tests and data are gathered related to enrolment and attendance; however, these do not measure many aspects of quality education. Missing are assessment and evaluation of life skills, perceptions, behaviours, and values, which are part of quality education.

Assessment for learning is being promoted in recent times in higher education (Carless 2015). Assessment for learning is an approach where the purpose of assessment tasks and practices is not just to focus on content knowledge and generating grades but rather on ensuring that relevant and meaningful learning occurs (Fry et al. 2015). This assessment approach can therefore be applied to the wide range of sustainable development knowledge, skills, values, and attitudes. In this entry, assessment for learning on sustainable development is defined as a systematic approach (or process) geared towards providing comprehensive evidence of learners' knowledge, skills, values, and attitudes related to sustainable development.

This entry provides a brief overview of assessment for learning and how it relates to conventional approaches to assessment. This overview is followed by a description of the key features of sustainable development and the role of education in its promotion. Examples of how assessment for learning can be applied to sustainable development will then be presented. The entry will end with preliminary suggestions on the way forward with regard to assessment practices in higher education that can promote sustainable development.

Assessment for Learning

Assessment for learning creates an environment where assessment is used continuously to support and enhance learning. Klenowski (2009) describes it as a natural part of the everyday practice of teaching and learning by students and their teachers. This purpose of assessment is different from that called "assessment of learning" (Earl 2013) or "summative assessment" which is carried out for grading and reporting on students' achievement, ranking, certifying, and accountability (Sambell et al. 2013). Assessment for learning on the other hand requires that evidence of learning be provided to teachers and students while learning is occurring rather than at the end

of the process (Fry et al. 2015). When evidence of learning is provided right away, it can be acted on, and necessary adjustments to the learning process can be made. This can in turn ensure improvement of the outcomes of the learning process.

Feedback is very important for providing evidence of learning in the assessment for learning model. Black and Wiliam (1998) reported on a review of a wide range of research on assessment and concluded that assessment that focuses on providing good quality feedback to students does promote learning and improve students' performance. When the feedback information from an assessment activity is used by teachers and their students to modify teaching and learning, respectively, the purpose of assessment is said to be formative (Ussher and Earl 2010). In addition to good quality feedback from teachers or peers, students can assess themselves and generate feedback. Assessment for learning includes the sharing of learning goals so that required targets are known, the use of student-centered strategies such as open-ended questioning, and the opportunities for learners to monitor, evaluate, and reflect on their performance. Assessment for learning enhances students' motivation and commitment to learning. This is because they understand exactly what they are expected to learn, or what skills they are to display, and they are given feedback and advice on how to improve their work. One of the main arguments of assessment for learning is that all forms of assessment activities should help students to learn. Because of this view, both formative and summative approaches to assessment can be incorporated in assessment for learning. More importance should however be placed on formative assessment because of its usefulness in allowing students to practice valuable skills before summative assessment is required (Sambell et al. 2013).

Sustainable Development and the Role of Education

The concept of sustainable development is rooted in concern about the ability of the environment to provide for the needs of human beings and ensure survival without depleting the natural resources including drinking water, food, energy supply, and clean air. The most commonly quoted definition of sustainable development is that stated in the 1987 Brundtland Commission Report on Environment and Development ("Our Common Future") as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development [WCED] 1987:43). The Brundtland Report fueled a new global awareness that in order for development to be sustainable all the dimensions or spheres which affect the environment must be incorporated (e.g., economic and social). Further, it is important to acknowledge that the dimensions are interdependent and interconnected and that all should be taken into account in any decision-making process about the environment (Duran et al. 2015). Additionally, it must be noted that addressing environmental concerns and sustainable development needs might be influenced by the cultural context in which they exist and by what is valued in each respective country. Culture is therefore viewed as another important contributor to the success of sustainable development (UNESCO 2012).

The focus of the Brundtland Report was maintained and relayed to the United Nations Conference on Environment and Development [UNCED] ("The Earth Summit") held in 1992 in Rio de Janeiro. Agreements were made at this conference by over 170 countries to act on a number of proposals to achieve sustainable development by the twenty-first century. "Agenda 21" which came out of the Rio Earth Summit promoted education as being:

> . . .critical for promoting sustainable development and improving the capacity of the people to address environment and development issues...It is critical for achieving environmental and ethical awareness, values and attitudes, skills and behaviour consistent with sustainable development and for effective public participation in decision-making. (UNESCO 1992, Chapter 36: 2)

Education was proposed as a powerful, major, and ideal driver for promoting the principles of sustainable development. The role of education was somewhat cemented when the United Nations

declared 2005 to 2014 as the "Decade of Education for Sustainable Development" with the intended focus on integrating sustainability education into all aspects of learning. The follow-up to the decade is the "Global Action Programme on Education for Sustainable Development" and the adoption of the "2030 Agenda for Sustainable Development" (United Nations 2015). Related to the 2030 Agenda are 17 Sustainable Development Goals which were developed, each with specific targets to be achieved by 2030. The importance of education to the success of sustainable development was maintained in the 2030 Agenda. Of the 17 Sustainable Development Goals, Goal 4 has targets that are all education-related. Education is targeted because the framework exists to assist individuals in acquiring, fostering, and demonstrating the specific knowledge, skills, values, and attitudes needed for making informed decisions and taking appropriate actions about the environment (UNESCO 2014).

Applying Assessment for Learning to Sustainable Development

If education is to succeed in promoting sustainability, there must be teachers who can use relevant strategies to assist their students in developing the knowledge, skills, attitudes, and behaviors to address sustainability issues. The teaching strategies in turn should be aligned with appropriate assessment strategies that keep educators current with students' progress in acquiring the associated knowledge, skills, attitudes, and behaviors. The summative end-of-course types of assessment such as multiple choice tests which are traditionally used in higher education do not provide opportunities for learners to demonstrate sufficient understanding of complex issues such as those related to sustainability. Summative assessments tend to focus mainly on content knowledge and generating grades and should not be used alone as they would not yield sufficient evidence of learning. Rather than assessing a learner's ability to write about sustainable development, it is more effective to measure the extent to which the student can put into practice and demonstrate what he or she has learned. Assessment for learning is aptly suited for this purpose because it is more holistic in nature and promotes lifelong learning (Sambell et al. 2013).

The issues related to sustainability are multidimensional and complex. It follows that teaching, learning, and assessment approaches related to sustainable development within education institutions must also be multidimensional, inter- and transdisciplinary, reflecting the interconnected nature of sustainable development. In order to evaluate knowledge, skills, values, and attitudes associated with sustainable development, UNESCO (2017) suggests that learners should be assessed with performance-based methods. In other words, it requires asking students to demonstrate sustainable development skills that are transferable to their future lives by performing tasks or by creating something.

Another major desired outcome of sustainable development is taking *action*. If students are to build their confidence to take actions to alleviate present and future negative environmental effects, then assessment related to sustainable development must be carried out in authentic contexts inside and outside the classroom. This approach will give students opportunities to implement their classroom learning in real-life situations. Interactive assessments carried out in authentic contexts are well suited to sustainable development, as they will foster and nurture students' twenty-first-century skills and competencies such as collaboration, communication, and creativity (Scott 2015). Assessment modes that expose students to complex problems will also allow them to develop respect and tolerance of other students' differing values and perspectives of the problem. Further, higher-order thinking and problem-solving skills are exercised in authentic situations as students make their own inferences about the issues. Peer and self-assessment which are also emphasized in assessment for learning also provide opportunities to capture insights gained and to allow for reflection on these.

There are a number of ways in which students can be assessed for achievement of sustainable development outcomes. Consideration should be given to the relevant learning outcomes when

devising all assessment tasks (UNESCO 2017). Teachers should ask questions such as "What specific knowledge and skills are students expected to demonstrate in this specific context?" and "What assessment types are best for capturing students' skills and competencies which are considered vital for sustainable development?"

There are some key components of assessment that should be considered if it is to be used to facilitate the development of knowledge, skills, and competencies related to sustainable development. These include:

- Using tasks that enable the development of communication, critical thinking, and problem-solving skills through collaboration
- Providing opportunities to apply these skills to real-world problems
- Integrating activities that allow students to connect learning about sustainable development across various subject areas
- Students participating in activities that encourage adoption of values, attitudes, and behaviors relevant to sustainable development
- Providing tasks that allow students to engage the perspectives of a wide variety of persons including stakeholders external to the institution
- Opportunities for peer evaluation
- Reflecting on experiences and personal development (The Higher Education Academy 2014; UNESCO 2017)

Assessment for learning utilizes a wide range of tools and strategies which can ensure the achievement of these components. Some of these strategies called performance-based assessment, authentic assessment, or alternative assessment require that students construct an answer, produce a product, or perform an activity linked to real-world situations as opposed to just recognizing and selecting predetermined options (Frey and Schmitt 2007; Darling-Hammond and Adamson 2010). Darling-Hammond and Adamson explain:

> Because they allow students to construct or perform an original response rather than just recognizing a potentially right answer out of a list provided, performance assessments can measure students' cognitive thinking and reasoning skills and their ability to apply knowledge to solve realistic, meaningful problems. (2010:7)

These kinds of tasks which are ideal for assessing sustainable development knowledge and skills include portfolios, reflective journals, debates, speeches, role-play/drama, case studies, making of models, presentations, project-based learning, problem-based learning, and work or industry-based learning. These assessments are usually used along with a rubric (Brookhart and Chen 2015) which is designed to clearly describe the specific knowledge, skills, values, and attitudes desired along with how to grade them. The rubrics also provide feedback for the students thus promoting their learning. Essays, checklists, rating scales, questionnaires, and interviews are useful tools for assessing skills, values, attitudes, and behaviors (Herman et al. 1992) related to sustainable development.

Higher education institutions play a major role in the achievement of sustainable development goals because of their collective intellectual capacity and academic freedom to "develop new ideas, to comment on society and its challenges, and to engage in bold experimentation in sustainable living" (Cortese 2003). Higher education systems are well versed in conventional teaching and assessment methods that provide a measure of how much content knowledge was successfully transmitted (Nicolaides 2012). Nicolaides suggests that this is mainly because of large class sizes as well as students themselves preferring the more conventional methods. Educators in higher education institutions need to practice the use of strategies that will allow for assessing sustainable development knowledge, skills, values, and attitudes. Of all the required components, the observation and rating of values, attitudes, and behaviors are likely the most difficult aspects to be assessed. The following are some examples of alternative assessment strategies and how they can be used.

Case Studies

Assessment using case studies are highly relevant for sustainable development. The content in a case is in the format of a narrative accompanied by

questions and activities (Bonney 2015). Case study narratives allow for the use of a wide range of authentic experiences to promote concrete application of knowledge to real-world situations. Case study investigations allow for collaborative discussions on authentic issues that provide opportunities for students to articulate and clarify the principles and values on which environmental decisions are made and to propose strategic actions for addressing the issues. The authentic nature or cases can be enhanced by utilizing data from peer-reviewed papers, professional reports, news articles, and videos that closely match the concepts and issues that need to be identified and discussed. For example, cases could deal with transportation challenges and pollution in urban areas, excessive hunting of wild animals, and mining and housing developments and their impact on the environment. The cases should be accompanied by carefully constructed instructions to clearly guide students' thinking and expressions.

Dramatic Activities

Dramatic activities involve role-play and simulation of real-world situations and experiences some of which may be familiar to students. The aim of role-play and simulation activities is for participants to re-create events and activities, which may involve taking on the role of someone else by imitating their character and behavior.

Dramatic activities naturally involve students working alone, in pairs, or in groups. Dramatic presentations ideally facilitate and enhance creative, communicating, questioning, and problem-solving skills. As students work on situations, they practice taking positions, establishing empathy, and understanding others' feelings, ideas, and behaviors (United Nations Environment Programme [UNEP] 2018). Because the situations used are authentic, as students act and express themselves, knowledge, skills, values, and behaviors can be observed and assessed to determine changes. Dengler (2008) cites an example of using a "mock climate change negotiation exercise" in order to expose higher education students to the complexities of negotiating an "international treaty." In another example, Blanchard and Buchs (2010) created a simulation game as an assessment activity to address sustainable development. The game was created to foster students' knowledge and awareness, to develop interaction and decision-making skills, and to become responsible citizens. Dramatic activities also allow students to link with their communities by performing plays for schools or other community events to raise awareness on environmental issues.

Portfolios

A portfolio is a collection of documents and other forms of evidence representing students' work and progress (Popham 2014) through the learning process. Portfolios are fairly easy to use as they require no technical inputs. The nature of the portfolio and what should be included are decided by the learning objectives. It can also be tailored to match individual students' specific factors and therefore represents his or her uniqueness. In using portfolios to assess students' progress in sustainable development, they could gather, for example, documents and photographs from newspapers and magazines or from students' own surroundings. The items in the portfolio would be useful in indicating students' values and interests. In addition, students can also be asked to write reflective pieces on the items they have selected for their portfolio including the reason(s) for their inclusion (Nicolaides 2012). This would promote self-assessment practices which are a feature of assessment for learning. Portfolios can be evaluated by either considering the ongoing compilation process as well as the final product. In addition, evaluation of the individual items in the portfolio or the entire collection of items can be considered.

Projects

Projects are ideal for the collection of physical evidence related to an assignment to demonstrate learning (Carless 2009) on specific tasks. Tasks can be built around authentic situations requiring solutions related to students' context. Students identify a problem, propose solutions, investigate, implement solutions, collect, and analyze data. Projects facilitate collaboration with peers and

other stakeholders in the community in which the institution exists. Students can also work individually on projects. Students may also develop a research project and propose implementation strategies and expected outcomes without having to carry it out. Similarly to portfolios, both the process and product can be assessed in projects (Butler and McMunn 2011).

Reflective Journals

Journals provide an opportunity for students to record and reflect on their learning experiences and how they have developed over a period of time (Butler and McMunn 2011). They can also be used to write projections about how current learning will influence future actions. Reflective journals represent a synthesis of learning as they can gauge the knowledge, skills, attitudes, and values achieved by students. Journals encourage deep reflection on issues and provide teachers with evidence of students' understanding, changed beliefs, emotions, and attitudes and can be used in tandem with other assessment forms such as project-based learning.

Journals have no specific format or requirements for what students should write. For example, teachers can provide questions as prompts, or students can be asked to reflect on their learning experiences. Teachers can also determine the frequency with which students will add content to their journals.

Work- or Industry-Based Learning

In this assessment approach, students are sponsored by companies and organizations external to the institution, and they spend some of their time at these sponsoring companies. Work placements give them opportunities to gain practical skills (Coll et al. 2003) and to have a broad understanding of the social and cultural context in which they will work so that in the future they will "make a difference."

Coll et al. (2003) propose three models linking sustainability to workplace experiences. One of the three suggests exposing students to relevant knowledge and values in the classroom which they then take into the workplace. The students can then be observed and assessed for their demonstration of transfer of learning.

In order to promote sustainable development, students could be placed in organizations such as nongovernmental organizations where they can directly interact with issues that relate to sustainable development to gain experience as they apply the relevant skills to addressing them.

Assessing Values, Attitudes, and Behaviors

Values, attitudes, and behaviors are affective or dispositional learning outcomes and have to be assessed as part of the indicators of accomplishment of sustainable development goals. These outcomes are difficult to measure; however, instruments (e.g., Likert types) have been developed and commonly used for this purpose. In addition, interviews can be used to determine values and attitudes if questions are posed in a way to obtain honest answers. Journal entries, drawings, and other artistic products also provide a means of assessing affective outcomes (Suskie 2009).

In order to assess behaviors, they have to be observed. Criteria are selected on which students' behavior is judged. Teachers will note whether the behavior is displayed or not, or they could determine the frequency with which the behavior is displayed. Observation of behaviors can be applied to any of the performance assessment strategies.

Scoring

The kinds of scores obtained from assessment tasks used in performance-based assessment for learning can run into the danger of being subjective. This is so because students create their own responses, and there may be no "right" or "wrong" answers. For example, if students are asked to give their opinions on matters related to the environment, these opinions would vary and would not necessarily be "correct" or "incorrect." Instead, the quality of the response should be the focus.

Subjectivity can, however, be reduced with the use of rubrics. Rubrics contain the criteria which

are the factors used to determine the quality of the students' responses and behaviors. Rubrics also have qualitative descriptions for each criterion that ensure distinctions in the students' responses and behaviors (Butler and McMunn 2011). These ensure that everyone who is using the rubric understands what is expected. Rubrics assist teachers to be accurate and fair if they apply it consistently and in an unbiased manner. Scoring can be carried out analytically (awarding scores to each criterion) or holistically (awarding a score based on all the criteria collectively) (Butler and McMunn 2011).

Conclusion and Future Directions

It is of paramount importance that the present and future generations fulfil the mandate of sustainable development. Higher education institutions are well-placed to play a critical role in this effort. This means that teaching, learning, and assessment strategies in these institutions should be reviewed to ensure they are aligned with all the learning objectives as well as the dimensions related to sustainable development. This would require huge efforts of the leadership within these institutions.

Assessment for learning is an approach to assessment that focuses on using assessment as a learning tool. Faculty and students within universities and colleges are generally familiar with traditional forms of assessment that focus on acquisition of knowledge and may be enjoying success in its use. In the context of achieving sustainable development goals, greater efforts are needed to understand and apply more alternative forms of assessment that serve as opportunities for students to demonstrate their learning. This is because sustainable development objectives are a mixture of cognitive and affective skills requiring students to collaborate on authentic tasks. Lack of understanding of sustainable development as well as assessment for learning approaches could lead to resistance against implementation for both faculty and students. Unsuccessful implementation could lead to false impressions that the strategies do not work. This has implications for teacher professional development efforts and may require ongoing training and participation in learning communities for faculty (Vlachou 2015) and awareness of the range of strategies available for gathering evidence of students' learning (Heritage 2007). Harrison and Wass (2016) pointed out that faculty members often contribute to undermining the intentions of assessment for learning, with Vlachou (2015) suggesting that this may be due to lack of understanding of its principles. In addition to understanding the principles of assessment for learning, faculty would need to strive to achieve an ideal balance between the use of the traditional forms and alternative forms of assessment.

Conducting assessment in authentic situations requires partnerships with a wider array of stakeholders including organizations such as workplaces, businesses, and industries. The benefits of such partnerships would be numerous and reciprocal. Students can gain specific knowledge and experiences from their interactions in the workplaces, while the employees can feel they are contributing to secure more sustainable futures.

Overall a change in the organizational culture of higher institutions might be required from a focus on assessment that is individualistic and competitive to one that requires cooperation and collaboration. A shift from the dominant use of traditional, paper-based assessment tasks to more student-centered practical experiences would also be needed. Furthermore, focus should be given to the affective skills which are largely disregarded in favor of content knowledge.

In this entry, the assessment for learning approach was described and applied to the knowledge, skills, values, and attitudes related to sustainable development. This approach to assessment is lagging particularly in higher education institutions, and much work remains to be done on its understanding and implementation. Higher education institutions are well-placed to be at the forefront of demonstrating how this can be successfully done in the context of achieving sustainable development goals.

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Assessment of Sustainability Capabilities

► Assessment of Sustainability Competencies

Assessment of Sustainability Competencies

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Synonyms

Assessment of sustainability capabilities; Evaluation of sustainability competencies; Measurement of sustainability competencies

Definition

Assessment of sustainability competencies may be defined as a process of drawing inferences about people's sustainability competencies on the basis of evidence gathered by using reliable and valid assessment tools. The process of assessment of sustainability competencies starts with decisions regarding what to assess (knowledge, skills and attitudes with respect to real-world sustainability problems); and how to assess (assessment strategy; tools for assessment; strategy to interpret data).

Introduction

Assessment of sustainability competencies is a complex, cyclical process of planning assessment of sustainability competencies, developing assessment tools, gathering data, analyzing data, and making judgements to inform decisions. Like any other assessment, assessment of sustainability competencies is a process not an event. The purpose of the process is to constantly learn about the level of students' competencies to make further decisions at classroom level, university level, or national level. Assessment helps the educators to revisit their pedagogies if some students are not developing desired competencies. Assessment of sustainability competencies is useful for the overall university too. It provides a complete picture of students' level of sustainability competencies. This is important in revising curricula, course contents, programs, university policies, etc. Key concepts associated with assessment of sustainability competencies are sustainability competencies, assessment, types of assessment, tools of assessment, and tools for assessing sustainability competencies. The following sections explain these associated concepts. Moreover, research on assessing sustainability competencies has also been described briefly.

Sustainability Competencies

The concept of sustainability competencies has received attention in the past two decades as an attempt to provide an outcome framework for education for sustainable development (ESD). The need for sustainability competencies arose from the criticism of ESD as a vague, non-outcome- based construct (Mochizuki and Fadeeva 2010). Some researchers found ESD goals as a set of ideals and lofty aims devoid of any context and focus (Stevenson 2007). Vagueness of ESD goals leads the scholars to identify outcomes of ESD. Scholars have conceptualized ESD outcomes differently like sustainability competencies (de Haan 2006; Jensen and Schnack 1997; Wiek et al. 2011), sustainability literacy (Stibbe and Luna 2009), sustainability consciousness (Berglund et al. 2014), and sustainability capabilities (Thomas and Day 2014). It is also important to note that different conceptualizations of ESD outcomes contain similar elements or

overlaps. The difference lies in conceptualization of the term. For example, Thomas and Day (2014) have used the concept of "sustainability capabilities." They argue that capability is more neutral than competence. Moreover, competence is associated with behaviors regarding completion of specific and detailed tasks. Behavioristic orientation makes ESD outcome mechanical. Similarly, proponents of sustainability literacy find the term literacy broader than competence. To them competencies are part of overall sustainability literacy (Stibbe and Luna 2009). On the other hand, advocates of the term sustainability competencies find it more meaningful as it is much focused as compared to other terms.

Sustainability competencies may be defined as a set of "knowledge, skills and attitudes that enable successful task performance and problem solving with respect to real-world sustainability problems, challenges and opportunities" (Wiek et al. 2011, p. 204). Real-world problems are complex and transdisciplinary. They are also recognized as "wicked problems" (Brundiers et al. 2010). To deal with the real-world problems, people need to be aware of the complexity of the problem. They should have knowledge of the connections between economy, environment, and society. Moreover, they need to have cognitive and motor skills and pro-sustainability attitudes to address the real problems effectively. Sustainability competencies is an umbrella term used to represent knowledge regarding economy, society, environment, and their inter-connectedness; cognitive abilities to critically analyze and solve problems; and pro-sustainability attitudes.

Wiek et al. (2011), in their meta-analysis of sustainability competencies, categorized the key sustainability competencies in five groups. Each competency is a set of knowledge, skills, and attitudes. Five categories are systems thinking, normative competence, strategic competence, anticipatory competence, and interpersonal competence.

Systems thinking refers to the ability to look at things as a whole. It requires analysis of the systems across three domains of sustainability, i.e., society, environment, and economy as well as across different scales, i.e., local to global. Systems thinking allows to consider inertia, cascading effects, feedback loops, and other systemic features related to sustainability issues and sustainability (Wiek et al. 2011). Systems thinking needs systemic knowledge which includes concepts such as structure, function, and cause-effect relations. It also requires perceptions, motives, decisions, and regulations (Wiek et al. 2011). The category of systems thinking covers two sub-competencies identified by de Haan's (2006). They are competence in interdisciplinary work and competence in cosmopolitan perception. Systems thinking is important to understand the "wholeness" and enact accordingly. As real-world problems are not compartmentalized in different subjects or disciplines, therefore, their solutions require systems thinking. Systemic thinking, interconnected thinking, and holistic thinking are the terms used interchangeably with systems thinking (Wiek et al. 2011).

Normative competence is "the ability to collectively map, specify, apply, reconcile, and negotiate sustainability values, principles, goals, and targets. . .This capacity is based on acquired normative knowledge including concepts of justice, equity, social-ecological integrity, and ethics" (Wiek et al. 2011, p. 209).

Anticipatory competence refers to "the ability to collectively analyze, evaluate, and craft rich 'pictures' of the future" (Wiek et al. 2011, p. 207) regarding the issues of sustainability. Anticipatory competence resonates with de Haan's (2006) "foresighted thinking." Future problems are unseen. However, it is expected that people should be competent enough to foresee the future problems. This anticipatory competence will allow them to plan for the future.

Strategic competence is the ability to "collectively design and implement interventions, transitions, and transformative governance strategies toward sustainability" (Wiek et al. 2011, p. 210). Strategic competence is about decision making. Sustainability problems are complex and multidimensional. Strategic competence involves cognitive skills of analysis, evaluation, and planning. Knowledge of sustainability issues is a basic element of the competence.

Interpersonal competence is "the ability to motivate, enable, and facilitate collaborative and participatory sustainability research and problem solving" (Wiek et al. 2011, p. 211). Sustainable development is a collective ideal. It requires collective work. Interpersonal competence is a key competence regarding collaborative work. Interpersonal competence comprises of advanced skills in communicating, deliberating and negotiating, collaborating, leadership, pluralistic and transcultural thinking, and empathy (Wiek et al. 2011).

Assessment

Assessment is usually described as a process of gathering and interpreting information to make judgments about students' learning and achievement to guide future decision. The future decision could be about how to address students' weaknesses in the next class or it could be about prompting students in the next grade or placing students in a professional program. Assessment is a key link between learning outcomes, content, and pedagogy (Black et al. 2011). Assessment, evaluations, and measurement are technically different terms. However, they have been used interchangeably by some scholars. There are three common categories of assessment on the basis of purpose of assessment. They are diagnostic assessment, formative assessment, and summative assessment.

Diagnostic assessment aims at identifying students' academic strengths or weaknesses and then identifying an appropriate strategy to address students' weaknesses. *Formative assessment* is also known as "assessment for learning." "It is used to provide feedback to pupils and teachers to promote further learning and to allow genuine dialogue between pupils and teachers about progress so that pupils' learning is promoted and teachers' planning is effective" (Atjonen 2014). The purpose of formative assessment is to improve students' learning. *Summative assessment* is done at the end of instruction periods. Duration of these instruction periods may vary from a month to a year. This kind of assessment is also known as "assessment of learning." Summative assessment aims to represent individual achievement regarding taught content or skills over a certain period of time. The focus is on achievement (Black et al. 2011). Summative assessment is important as it may improve motivation and can help student, teachers, and parents to compare performance of different students. Summative assessment provides an opportunity to the districts, states, or provinces to compare performance of different schools by comparing average scores of students in a particular grade level.

Both types of assessment are needed for learning. Both formative and summative assessments can serve the purpose of diagnostic assessment.

Self-Assessment and Peer Assessment

The terms "self-assessment" and "peer assessment" are commonly used in assessment discourse. They refer to the method of assessment. Reports written by students regarding their own learning are called self-assessment. Conversely, peer assessment refers to assessment conducted by peers. Both self-assessment and peer assessment processes are important in validating teacher-generated assessment reports. Moreover, they develop students' evaluation skills.

Key Questions in Assessment

Good assessment starts with planning of assessment. It requires answering the following questions:

- Who to assess?
- Why to assess?
- What to assess?
- When to assess?
- Where to assess?
- How to assess?

Who to assess refers to the audience of assessment. Age group, gender, and study programs are important considerations while planning for assessment.

Why to assess refers to the purpose of assessment. The assessor should clarify if they are going to "assess for learning" or "assess learning."

What to assess is another important consideration at the planning stage. It involves identification

of criteria against which the assessment is to be made. Assessors need to be clear if they are going to judge cognitive learning, psychomotor learning, or affective learning. Moreover, they need to further delineate the construct to be measured.

When to assess is about the timing of assessment. Timing of assessment is decided on the basis of the purpose of assessment. If the assessment is formative, then assessment will be done during routine classroom time. If the assessment is summative, then assessor decides appropriate time after finishing certain content.

Where to assess is another important question in assessment. Assessment criteria determine assessment location. If assessor wants to assess a young doctor's surgery skills, then surgery room will be the appropriate location. On the other hand, if the assessor wants to assess young doctor's knowledge of surgery, then it can be assessed in examination hall.

How to assess refers to the methods and tools required to gather data. TenBrink (1999) identified four methods or strategies of assessment. They are:

- Testing
- Analysis
- Observation
- Inquiry

Testing is used to assess cognitive learning. There could be formal or informal testing. Informal testing involves questioning during classroom. It could take any form, oral, or written (paper pencil test). Summative assessment involves formal testing. Students are informed about the date, place, and time of examination. They are also communicated with the content they would be assessed on. Testing is used to assess students' factual knowledge, comprehension, application skills, analytical, synthesis, and evaluation skills (Bloom 1956). To assess students' higher-order thinking skills, assessor develops rubric or criteria. Rubrics help in fair and reliable assessment. Paper pencil tests are the common tools employed during testing.

Analysis is used to assess cognitive and psychomotor skills. An artist's painting skills or an author's writing skills could only be assessed by analyzing their work products. Analysis is done by using a rubric or criteria for reliable, unbiased assessment.

Observation is an assessment strategy used to assess feelings and psychomotor skills. If an assessor wants to know the equipment handling skills of undergraduate science program, then they would employ observation strategy. Equipment handling cannot be assessed through paper pencil test. Observation could employ observational checklists as tools or there can be unstructured assessment.

Inquiry is an assessment strategy used to know about people's opinions, perceptions, or feelings. Inquiry is the least reliable method to assess cognitive skills of the students. Inquiry may be done by using tools of questionnaire or interview.

Assessment of Sustainability Competencies

Sustainability competencies have three components: knowledge, skills, and attitudes. These three components belong to three domains of learning. Knowledge of sustainability and intellectual skills (recalling, comprehending, applying, analyzing, synthesizing, and evaluating) come under the category of cognitive learning, whereas the ability to do something physically or motor skills come under psychomotor domain. Attitudes belong to the affective domain of learning. Assessment of the sustainability competencies would involve assessment of knowledge, skills, and attitudes toward sustainable development. Moreover, the assessment needs to measure all sustainability competencies, i.e., systems thinking, normative competence, and anticipatory, strategic, and interpersonal competence. Scholars have tried to develop tools to measure knowledge, attitudes, and behaviors toward sustainability (Biasutti and Frate 2017; Michalos et al. 2012). However, there is relatively less literature reporting tools to assess sustainability competencies. Rodríguez-Aboytes and Nieto-Caraveo (2018) developed an assessment framework to investigate the level of sustainability competencies of the secondary school students

in Mexico. Their instrument consisted of a performance task and questionnaire to measure knowledge and attitudes of the students.

Assessment of sustainability competencies needs to be done by using testing, observational, and inquiry methods. Reliable assessment of knowledge of sustainability issues can be done through testing, whereas cognitive and psychomotor skills need to be analyzed by using rubrics. Attitudes may be assessed through observation or inquiry method. Inquiry method of assessment cannot produce reliable results regarding knowledge domain. A valid and reliable assessment of sustainability competencies would consider basic questions of assessment which are related to the purpose, audience, criteria, location, and timing.

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Attitude Change to Sustainable Development

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Synonyms

Attitudinal transformation to sustainable development; Attitudinal change to sustainability; Attitudinal change to environment, society, and economy

Definition

Attitude change towards sustainable development (SD) may be defined as a change in one's feelings towards the issues related to environment, society, or economy. It is about developing a concern and feeling for the planet earth and life on it (humans and other living creatures). In other words, a change in attitude towards SD refers to feeling bad for

environmental destruction, climate change, oppression, and socioeconomic injustice. It also involves a strong feeling of undertaking pro-sustainability actions at individual or collective levels.

Introduction

Attitudes towards sustainable development (SD) may be described as enduring feelings towards the issues related to environment, society, or economy. SD or sustainability refers to two ideals, i.e., sustaining and developing. Nature (earth, biodiversity, ecosystems), life support (environment, resources), and community (culture, groups, places) have to be sustained while people and economy need to be developed (Leiserowitz et al. 2006) through education, fair governance, equitable and equal opportunities, and fair economic policies at global and national levels. Both targets of SD, i.e., sustaining and developing, require change in people's values, attitudes, and behaviors. Sustainability is a value like freedom or democracy. Like other values, sustainability is an abstract ideal which is expressed through attitudes in the form of positive or negative feelings. Attitude to sustainable development reflects the extent to which people value sustainability, i.e., environment, economy, and society. Attitude change towards SD may be described as developing a concern and feeling responsible for three elements of sustainability. Attitude change to SD is important because of two major reasons: (1) it can positively influence people's behavior towards economy, society, and environment; (2) it can change people's relationship with the world around. Though attitudinal change is pivotal in transition towards SD, it is difficult to achieve because of the complexity of the construct of "attitude." Before discussing attitude change to sustainable development, it is important to understand the concept of "attitude," how is attitude developed, and the relationship between attitude and behavior.

Attitude and Attitude Development

Attitude is a psychological construct and has been defined differently by different theorists. Tabacbnick and Zeichner (1984) perceive attitudes as opinions with dispositions to act. Eagly and Chaiken (1993) view attitude as a psychological tendency to favor or disfavor something. It is also considered as a general and enduring positive or negative feeling about some person, issue, or object (Petty and Cacioppo 1981). An attitude object is something that is evaluated along a dimension of favorability. Attitude objects can be abstract (feminism) or concrete (a vehicle). It is also important to note that attitudes differ in valence and strength. Valence means categories of feelings like positive, neutral, and negative, while strength means "intensity of feelings." We may have positive attitude for the idea of sustainability; however, the intensity of the attitude could be different.

Attitudes are closely linked to values and beliefs. In fact, beliefs, attitudes, and values collectively constitute individuals' belief system. Beliefs are mental constructions (cognitive frames) taken as true, while attitudes are more about feelings. However, when different clusters of beliefs are organized around a person, object, or situation and predisposed to action, this holistic organization becomes an attitude (Pajares 1992). In this sense, attitudes are informed by one's set of beliefs. As beliefs are cognitive constructions, therefore it can be assumed that attitudes also have cognitive character along with affective dimension. Like beliefs, values are closely related to attitudes. Often, attitudes derive from and reflect abstract values (Leiserowitz et al. 2006).

Attitudes are not directly observable. They may be inferred from what people say, intend, or do. However, the scope of a measured or inferred attitude from the behavior is broader than the measure of a behavior. For example, the attitude inferred from the behavior of "using public transport" may be "environmental care." The inferred attitude is much broader than the observed behavior. Although the link between attitudes and behaviors is not always clear (Kollmuss and Agyeman 2002), behaviors are frequently used as a measure to determine people's attitude. The other ways of measuring attitudes are self-reported questionnaires.

People develop their attitudes towards something (object, person, or issue) as a result of their

prior experiences. For example, if a person experiences that women are generally more helpful at workplace, then they may have positive attitude towards a stranger female. Similarly, people who experienced poverty may feel bad about the phenomenon, while others might have a neutral attitude towards poverty. It is also generally assumed that knowledge or information about something shapes one's attitude. However, studies from environmental psychology have shown no or weaker relationship between knowledge and attitude towards environment (Kollmuss and Agyeman 2002). People might have knowledge about the impact of pollution on human health and biodiversity, but they might not feel bad about people's choices which cause pollution.

Social psychology suggests that people transform their attitudes under different influences. Kelman (1958) in his classic study on the processes of attitudinal change mentions that compliance, identification, and internalization lead to attitudinal change. Attitudinal or behavioral change resulting from compliance means a person might accept social influence with a hope to achieve a favorable reaction from another person or group. Attitudinal change occurring through compliance is not rooted in one's values. People might change their attitude and behavior to establish or maintain satisfying, self-defining relationship to another person or group. This attitudinal change is also not rooted in one's values. Unlike compliance and identification, attitudinal change occurring through internalization is fully in-line with one's values. Attitudinal change occurring as a result of internalization is intrinsically rewarding.

Relationship between Attitude and Behavior

Studies from the field of environmental psychology show that people who have positive environmental attitude are more likely to engage in low-cost pro-environmental behaviors (Kollmuss and Agyeman 2002). A recent study of environmental behavior in cross-national perspective has shown that level of development of a country determines the relationship between attitudes and behavior towards environment. The study found a correlation between environmental behavior and attitude of the people who belonged to more developed countries (Pisano and Lubell 2017). Milfont and Sibley (2012) found that attitudes of openness and agreeableness were strongly associated to environmental engagement at personal level and at nation level.

It has also been found that positive attitudes do not always translate into behavior. For example, people with positive attitude towards environment might choose to use water carefully. However, they may not limit their air travel. Similarly, people who are concerned about gender equality may arrange same education and health facilities for their children (girls and boys). However, they may choose not to work under the leadership of a woman.

Attitude Change to Sustainable Development

There is a consensus in literature that SD cannot happen without a change in people's and nation's attitudes towards sustainability. Attitudes are predictors of people's behaviors and their relationship with the world around. Before discussing the expected change in attitudes towards sustainability, the need of attitudinal change and existing attitudes towards sustainability have been discussed in the next sections.

Need for Attitudinal Change to SD

Sustainability issues like climate change, depletion of natural resources, gender inequality, widening the gap between rich and poor nations, war, and discrimination cannot be addressed by informing people about the costs of economic development or telling them about the need of environmental protection, equality, justice, and peace. These issues require a complete shift in thinking and feelings towards the mentioned issues. Moreover, attitudinal change is a prerequisite for large-scale initiatives towards sustainability. Attitudes determine one's relationship with other people and the Nature. People with positive feelings/attitude towards equality (attitude object) would appreciate the ideas and actions based on equity to help achieve equality

in the society. This attitude indicates a relationship with and concern for the fellow beings. On the other hand, people having negative feelings towards "equality" would resist all those ideas and initiatives which are rooted in equity. People with neutral feeling would remain indifferent. This attitude indicates no concern for the fellow beings. It is expected that people who have positive attitude towards SD will be more receptive to sustainability initiatives.

Global Attitudes Towards SD

There is scarcity of literature reporting attitudes of general public as well as of university students towards sustainability. The most studied dimension of sustainability in terms of attitudes is environment. Global survey of environmental attitudes indicates that people from the advanced economies like the USA, Canada, Japan, Sweden, and Germany have least pro-environmental attitudes, whereas the people from developing economies are more concerned about climate change. They also feel responsible for overall environmental issues and look committed to change their lifestyles (National Geographic 2014). "Green at Fifteen," the study of OECD-PISA (2009), indicated that across OECD countries, a substantial proportion of students report a very high sense of personal and social responsibility towards environmental issues. However, most of them were not optimistic about the improvements of environmental situation. It is also important to note that students from many high-income countries like Australia, Sweden, and Norway had lower sense of responsibility towards environment when compared with average. A study of Pakistani university students' attitudes towards sustainability indicated a need for transforming students' attitudes towards sustainability (Kalsoom et al. 2017).

Scales Measuring Attitudes Towards Sustainable Development

There is scarcity of scales measuring attitudes towards sustainable development. Michalos et al. (2012, 2015) developed a scale to measure 10th grade students' knowledge, attitudes, and behaviors towards sustainable development. Kalsoom et al. (2017) modified and used the scale of Michalos et al. (2012) to measure attitudes of preservice teachers' and other university students towards sustainability. Biasutti and Frate (2017) developed and validated a quantitative 20-item scale that measures Italian university students' attitudes towards sustainable development. Torbjörnsson et al. (2011) developed a scale to measure upper secondary students' attitudes towards three values of sustainability: respect for nature, solidarity, and equality. Although researchers have developed and used different scales to measure attitudes towards SD, there is no agreed scale which has been used in cross-national, large-scale surveys to measure attitudes towards SD.

Expected Attitude Change to Sustainable Development

SD does not have an agreed definition so do attitudes for SD. However, researchers have built attitude measuring scales on the basis of sub-themes of SD identified by UNESCO. According to this, attitude change to sustainable development refers to change towards all aspects of sustainability. UNESCO (2006) has identified different sub-themes under three dimensions of sustainability:

Sub-themes under the environmental dimension.

Natural resources (water, energy, agriculture, and biodiversity), (2) rural development, (3) disaster prevention and mitigation, (4) sustainable urbanization, and (5) climate change.

Sub-themes under the economic dimension.

Corporate responsibility and accountability, (2) poverty reduction, and (3) market economy.

Sub-themes of the social dimension.

Human rights, (2) health, (3) gender equality, (4) peace and human security, (5) cultural diversity and intercultural understanding, (6) HIV/AIDS, and (7) governance.

Attitudes related to the abovementioned sub-themes may be labelled as attitudes towards sustainable development, whereas attitude change refers to developing positive feelings

for socioeconomic and environmental justice and negative feelings for all kinds of injustice. Some examples related to expected attitude change for SD are as follows:

- Believing unequal opportunities for females and males to education and employment.
- Discouraging discrimination on the basis of religion, race, ethnicity, color, gender, etc.
- Valuing sustainable lifestyles.
- Being concerned for the future generations.
- Appreciating legislative initiatives regarding fuel efficiency.
- Agreeing with the practice of equal sharing of household tasks among household members regardless of gender.
- Valuing democratic processes and practices.
- Disliking the use of disposables.
- Valuing water conservation.
- Believing that individual actions have a role in climate change.
- Feeling concerned about extravagant use of resources.
- Feeling concerned about the exploitation of the poorer by the wealthier.
- Disliking unequal distribution of wealth among people and nations.
- Believing that the people who pollute our land, air, or water should pay for the damage done to communities and the environment.
- Feeling bad about war and killings.
- Being concerned about unequal access to health facilities.
- Believing that environmental protection and people's quality of life are directly linked.
- Agreeing that government economic policies should increase sustainable production.
- Appreciating the need of sacrifices by the wealthier to reduce economic differences between populations.
- Believing in social responsibility in poverty reduction.
- Believing in fair trade.
- Being concerned about governance structure which deprives the poor.
- Feeling concerned about the people with serious health problems.
- Appreciating rural development programs.
- Believing that disasters can be reduced by protecting the environment.
- Being concerned about the human activities which are harming the environment.

Role of Education in Attitude Change to SD

Current education (school education and higher education) is not helping the students to develop pro-sustainability attitudes. In fact, the problems of unsustainability are the result of education (Orr 1994). With the increasing volume of education, pollution has increased. Similarly, more education is leading to more exhaustion of resources and the dangers of ecological catastrophe (Schumacher 1997). Similarly, more education is causing economic disparities all over the world. To address the problems of sustainability, a "different kind of education" (Schumacher 1997) is needed. Education for Sustainable Development (ESD) seems to be in line with Schumacher's concept of different kinds of education. The focus of ESD is on transforming students' thinking, attitudes, and practices towards economy, society, and the environment. The underlying assumption of ESD is that mere knowledge of SD is not enough to bring SD. It requires a deeper change, a change in thinking, attitudes, and behaviors.

Strategies to Attitude Change

Attitude change is more than cognitive learning. Awareness of an issue does not necessarily develop a feeling towards the issue. Attitude has cognitive and affective dimensions. Change in attitude towards SD is influenced by different factors like knowledge of sustainability issues, implications of unsustainability, people's training, and the context (Leal Filho 2010).

Literature shows that real-world pedagogies like problem-based learning, project-based learning, undergraduate research, service learning, internships, and action research can be useful in transforming university students' attitudes towards SD (Adomßent et al. 2014; Brundiers et al. 2010; Kalsoom and Khanam 2017; Lasen et al. 2015; Pretorius et al. 2016; Wiek et al. 2014). Problems

of sustainability are real-world problems. The aforementioned pedagogies allow the participants to work in real situations and engage with sustainability problems.

Actual engagement with the sustainability problems helps the participants understand the problems and develop a feeling. A person who has never interacted with people living in poverty would not be able to develop a feeling of empathy towards them. Similarly, people who have not experienced forced displacement or migration can neither understand the issue of forced displacement nor feel the misery of the victims. They can feel for the victims if they interact with them and provide some kind of services. Real-world pedagogies provide opportunities to the people to understand the real-world issues and develop an attitude to address them at individual or collective levels.

Critical dialogues on the future consequences of unsustainable development and injustice can also make people more concerned about the problems of sustainability. Similarly, media can educate people about the need of sustainable development with a possibility to change their attitudes too.

Barriers to Attitudinal Change Regarding SD

Attitudinal change towards SD is different from attitudinal change towards people or concrete objects like consumer brands. Sustainable development is an abstract entity. One cannot change attitude towards SD without fully internalizing the concept of SD. The idea of sustainable development is structured around justice and equality. Therefore, attitude change to SD means changing one's mind-set in favor of justice and equality. However, this kind of change is extremely difficult because dominant groups want to maintain their privileged positions in their societies. They can even take extreme steps like violence to maintain their power. Similarly, more powerful nations also establish inequitable economic and trade policies to keep large share of global wealth. There are two problems associated with the powerful groups: first, they act as predators and take huge share of economy; second, they act as role models for the disadvantaged groups. First step in attitudinal change of the powerful groups towards SD is a realization that their privileged social position is not because of their fate or their ancestors' hard work rather because of unequal access to economic and natural resources. Similarly, attitudinal change of disadvantaged groups towards SD involves an awareness of the societal oppression and that powerful group is not a role model.

Conclusion

Attitudinal change towards sustainability is pivotal to promote pro-sustainability actions at individual and collective levels. The world has agreed on sustainable development goals. These goals are the outcome of a positive attitude towards sustainable development. Their enactment also requires positive attitude of the implementers and the public. Though transformation in attitudes is difficult, it can be achieved through sustainability education. Universities are the key sites for sustainability education. They need to provide opportunities to the students to engage in tasks which can lead a transformation in their attitudes and behaviors. Universities should try to address psychological barriers involved in transformation of attitudes. Similarly, schools should also take a proactive role in helping students' learn pro-sustainability attitudes.

Cross References

- ▶ Behavior Change for Sustainable Development
- ▶ Deep Learning on Sustainable Development
- ▶ Norms and Values for Sustainable Development
- ▶ Sustainable Development
- ▶ Transformative Learning for Sustainability

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Attitudes

► Students' Perspectives on Sustainability

Attitudinal Change to Environment, Society, and Economy

► Attitude Change to Sustainable Development

Attitudinal Change to Sustainability

► Attitude Change to Sustainable Development

Attitudinal Transformation to Sustainable Development

► Attitude Change to Sustainable Development

Augmented Reality

▶ Digital Learning and Sustainable Development

Awareness of Sustainability Issues

Holistic Housing Sustainable Thinking

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Definition: Awareness of Sustainability Issues

Awareness of Sustainability Issues is to understand the fragility of the environment and the importance of its protection, thinking in terms of an ecological consciousness. It is related with the growth and development of awareness, understanding and consciousness toward the biophysical environment and its problems, including human interactions and effects.

Introduction

This work aims to analyze the theme sustainability awareness and what must be done so that such a consciousness is incorporated as a fundamental factor to the human species survival and life on the planet. In this way we intend to make an analysis of the application of this theme and also holistic practice, in sustainable housing projects.

In order to do so, it is necessary to reflect on how these concepts have been applied in such projects, since it is important to understand that business initiatives, especially those that generate great impacts by extracting resources for their economic activities, both to the environment and society, which is the case of the civil construction industry, should be fully aware of the consequences of their activities and minimize such effects (Bassetto 2010).

To Abidin (2010) the factors that will stimulate the incorporation of sustainable actions and movements are awareness and knowledge. The author highlights that with these factors incorporated come interest and demand and follow with implementation. He also agrees with views that emphasize that behavioral changes will only occur through personal commitments.

Gonçalves-Dias and Teodósio (2012) point out that changes in production patterns and consumption imply an increase in the level of information of the population, awareness of people, elimination of waste, development of technologies, shared responsibilities, and recycling, but above all changing from a behavioral pattern of the current society toward a sustainability awareness.

Roos and Becker (2012) stress that a sustainable system will only bepossible through the intellectual evolution of human beings, in addition to establishing environmental education processes in each society and promoting awareness of what sustainability really is.

According to Gadotti (2005), it should be noted that we live in a scenario where globalization implies a search for permanent technological development. Such development and the resource needs that they demand, according to the author, create a moment in which the idea of sustainability, although desired, undergoes great friction and tension. How can we promote full development and a real sustainable situation? According to the author, such concept is only a label for some while for others a logical absurdity since sustainability and development seem many times incompatible.

For Gadotti (2005, p.2), the term sustainability refers to much more than the preservation of natural resources as "it implies the balance of human beings with themself and with the planet, even more, with the universe." The author suggests a sustainability that is directly related to what the human being is and understands where he comes from and where he goes, a broader aspect before the vision of a being that gives meaning to everything that surrounds him.

Gadotti (2005) mentions that this subject will provide ample debate in educational media in the years to come. Education and openness to this broader perception of reality is undoubtedly the biggest challenge for the sustainability issue to be incorporated.

It should be noted that both the word sustainability and holism have been used very often and very comprehensively. Therefore, it's necessary to revisit the emergence of such concepts for only then to observe how they are applied, or should be, in a practical way and what are their possible uses in housing projects.

It also seeks to observe the influence that the housing projects receive from a strong consumer market, caused by a globalized world, where there is the stimulus to the constant creation of new products, most often not sustainable, and that takes the quest for social status through exclusivism.

Some data on the difficult times in which the current society and the planet are in will be presented, as well as aspects and techniques on sustainability regarding the construction sector.

Thus, it created a research path that can be structured as follows: first, the development of a study on the concept of sustainability and holism; second, what are the challenges presented in the current times for their effective application in sustainable housing projects; third, analyzing the characteristics of sustainable housing; and, finally, the attempt to understand if sustainability and holism have been incorporated in current building processes.

Sustainability, Holism, and Construction Practices

To deepen this issue is important to understand the concept of sustainability. Humanity in its process of evolution and social organization has created major changes in the environment. These changes allowed a life undeniably more comfortable and stable than previous generations. However, a generalized notion of development related to a naturally progressive and positive process to human societies has been questioned (Almeida 1999).

According to Almeida (1999) economic, environmental, and social crises have undermined the idea that progress as occurred in developed countries should be copied in full and that it would generate the same results obtained in developing countries. The author states that the humanistic character assigned to the development term has made the expression to be assimilated with a positive connotation of a favorable prejudgment, acknowledged as a good in itself.

Development generates industrial production techniques on a large scale in order to create products aimed at mass consumption, which, stimulated by economic theories, support the generated consumer society. According to Gadotti (2005), production unbalances lead to a situation where life on the planet can be greatly affected and even destroyed, without the use of atomic weapons. This can occur by environmental degradation and the misuse of all kinds of resources.

Today it is clear that the natural resources for the maintenance of society are finite and need to be used judiciously. Various experiments and human activities have made clear that inefficiency and carelessness in their productive activities create situations of immense risk, high impact either local or global. According to Langer (2017, p. 5):

> On one hand, capitalism has an enormous capacity to create wealth and goods, in addition to mobilizing, for this purpose, powerful technical, intellectual, material and financial. On the other, it presents an enormous capacity to ignore poverty and misery and transform landscapes, societies, norms and values.

Ribeiro (2002) states that one must consider that globalization, which took place from the 1980s, sought to create a homogenization of world culture. Clearly, this homogenization occurs based on consumer culture.

It should be considered that consumption is at the same time, according to MacCracken (2015), the process by which the creation of goods and services necessary for the maintenance and construction of the world and society may be sustained. But it is also a cultural phenomenon that involves desire, lifestyle, and demonstration of social status.

Understanding this search for social status promoted by consumption is extremely important when observed the way in which construction methods are applied. This is evident when it's considered that the "goods that are so often identified as an unfortunate and destructive concern of a materialistic society, are in fact one of the main instruments of its survival" (MacCracken 2015, p. 4).

Thus, it can be concluded that the practices and patterns of consumption and, consequently, the applied technological methods are the support base of a lifestyle and a society already established.

The changes needed to promote sustainable methods involve often immense efforts to demonstrate the mistake of these established social and cultural patterns. The author MacCracken (2015) demonstrates that the consumption of a product, including housing, shoot a very broad process which generates activities and resource exploitation that goes far beyond what can be observed as a final product, and it involves changes of deep cultural patterns. MacCracken (2015) shows how consumption is associated with the desire and often good portion of the population that aims to consume objects that are beyond their reach and that these desires promote the assumption that, through them, you can get new happiness, although such consumption is unsustainable, both regarding the economic aspect of the consumer and, more broadly, to the survival of the planet.

In the face of such placements, a question should be asked: what is sustainability?

According to Ferraz (2008), the concept of sustainability, the way it is understood today, emerged in the 1970s, from the Club of Rome, with its proposal for zero growth, with the claim that it is impossible to sustain a continued economic growth. Later, there is a good definition of the concept with the publication of the Brundtland Report, prepared by the World Commission on Environment and Development (1987), which defines: "Sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs."

Sustainability is therefore bound to the idea of continuity. For this, we need to create a harmony between economic and environmental issues, a balanced marriage between these two factors (Ferraz 2008).

For Baudrillard (2016) unbridled consumption, which creates an imbalance between the economic and environmental aspects, gives up the worship and admiration for the new. This admiration in turn makes new products; new appeals to the consumer arise constantly; it creates then a vicious circle of desire-consumption-production. This cycle generates waste, which, in turn, causes severe pollution and exploitation of natural resources.

And the idea of holism? The term holism has its origins in the eighteenth century presented by naturalist Gilbert White (Tristão 2004), based on the Greek cosmic vision, in which the word *Holos* means any or all and *Oikos* means home. In this concept, nature has a soul and a female intelligence. There is a unity between nature and humanity in a cosmic order (Naess et al. 1981).

The holism in part presents a reductionism, according to Tristão (2004), for the parts are understood as parts of a whole, but the complexity within this unit is not properly represented. For Tristão it must include "all as more or less than the sum of its parts (p. 106)." According to the author, the tensions and conflicts of contemporary society and its complexity hamper the understanding of holism as an entire aspiration paradigm. Tristão (2004) adds that holism, although will produce a major attraction and enchantment and is widely used in environmental education teaching, represses the heterogeneous, the sense of difference and cultural diversity that feed and stimulate the relationship between life and knowledge.

According to Sato and Carvalho (2008), the adoption of an anthropocentric view of the world proposes to control natural phenomena so that the earth is mastered and used in order to meet the needs and desires of human beings and their Cartesian thought. It is a vision that completely unbalances the holistic relationship between human beings and the environment in which they live.

Thus, it is urgent to understand the immense challenges that determine the application of such

concepts in the lives of individuals. Clearly it presents itself with all the points raised so far, a huge dilemma: how to keep moving forward as a society and, at the same time, to preserve natural resources to allow future generations and biodiversity to be sustained?

To try to answer that question, it is essential to understand that society is facing a challenge of managing key resources to the survival of life. Matias (2014) presents the current situation of the contemporary global society, as a tragedy of public welfare. The author mentions that public welfares are freely available for all to use in any way deemed suitable. However, it should be noted that, in a practical way, what is available to all is not administered or cared by anyone. And, at first, each one does whatever they want. Even though Matias (2014) mentions, theoretically, that public welfare is a market error related to property rights, therefore, to be collectively owned, they become, strictly speaking, owned by anyone, hence the lack of incentives for their protection. Its preservation is at the mercy of institutional and social rules often uncertain. The solutions that have been observed are the privatization and nationalization of these resources to ensure that they are managed and preserved. However, both solutions have their problems. Therefore, they are not exactly solutions, but elements that integrate this complex and controversial issue.

According to Matias (2014), in 2009 scientists that were studying anthropogenic pressures – induced by human being – on the global environment, stipulated nine planetary "limits" or "boundaries" which, if exceeded, would cause disasters that would put humanity at risk. These "limits" are:

1st – Ocean acidification, which absorbs a quarter of human emissions of CO_2; the presence of this gas in water increases its acidity, damaging marine biodiversity.

2nd – Ozone depletion, which, in turn, is responsible for filtering the sun's ultraviolet radiation stemming from the sun. The international community has dealt this problem with efficiency.

3rd – Chemical pollution, including radioactive compounds, heavy metals, and a wide variety of organic compounds of human origin. This pollution that was once considered localized and regional today shows itself as a global problem.

4th – Atmospheric aerosols that are organic and inorganic particles suspended in air as dust and soot from diesel engines, for example. These elements can either generate the atmosphere cooling by reflecting sunlight, or increase the heat, as soot generated by the combustion of biomass. In addition, such soot produces diseases such as asthma and bronchitis.

5th – Biogeochemical, human interference in the global cycling of phosphorus and nitrogen generated from food demand and hence fertilizers. Excess of nitrogen fertilizers is dumped into waterways causing expansion in the emergence of algae that affects the lives in rivers and lakes and causes abrupt changes in these ecosystems. This creates true dead zones in coastal regions.

6th – Freshwater, the global use of freshwater and pollution of this resource (one common good par excellence), which is used far beyond acceptable levels, especially in agriculture. This causes, among other problems, the reduction of soil and air moisture, generating droughts and hence the degradation of these soils. This problem already makes the situation critical for 40% of the world population suffering from water stress.

7th – Land use and the devastation of forests (agricultural expansion and livestock). The devastation of forests is a serious problem not only because of the wood being used as important raw materials but also because they preserve watersheds, protect the soil from erosion, and are essential as part of the water cycle, besides being habitats that provide biodiversity.

8th – Biodiversity loss and the extinction of several species associated with human actions. This is happening a thousand times faster than would be natural.

9th – Climate change generated by the greenhouse effect, which, in turn, is due to the presence of certain gases, released into the atmosphere, that do not allow part of the solar radiation that generates heat which would normally be reflected the space to be eliminated. This phenomenon leads to the rise in global temperature. The CO^2 produced by burning, by industry, by using fossil fuels, and by breathing and methane (CH4) generated by

landfills, the cattle, and the mangroves, for example, are the two gases that have greater participation in greenhouse effect causes.

To what extent housing construction methods exceed the abovementioned limits and how to make them to be truly sustainable? What does underlie a sustainable housing? According to John et al. (2001), the construction industry is the sector of the economy that consumes more materials worldwide including, among others, steel, cement, lime, sand, wood, water, and energy. All of it generates huge demand, degradation, and pollution in places where such resources are extracted and even where the works happen. The authors have signed yet that 50% of raw materials in Japan are consumed by construction and in the USA this natural resource consumption rises to the order of 75%. To further illustrate the "weight" of civil construction, the authors' state that 3% of the CO^2 generated globally derives only from the decomposition of lime to produce Portland clinker cement.

Half of all annual energy consumed in the USA, according to the Energy Information Administration System of the USA, refers to the construction industry (Ching and Shapiro 2017).

According to John et al. (2001), beyond the construction, we must also rely on demolition, which generates a huge amount of waste with high impact on the environment. The authors suggest the untying of development to the environmental burden that it promotes. This means that there is a need to optimize the use of resources, with reduced generation of waste to a minimum which should be recyclable. This new paradigm is called closed-loop or cyclical production model.

Regarding the idea of sustainability in civil construction, it is important to consider durability that is directly related to the useful life of the components used. For the durability of materials, it is necessary to analyze the climatic conditions where the components will be used, considering factors such as the incidence of solar radiation, temperature, salinity, pollutants content in the air, and humidity, among others.

In September of 2015, leaders of all United Nations state member (ONU 2015) formally adopted an action plan for the eradication of poverty, protection of the planet, and achievement of prosperity and peace. This plan, Agenda 2030 for Sustainable Development, has 17 goals, and the number of Goal 11.1 refers to "making cities and human settlements inclusive, secure, resilient and sustainable (ONU 2015)."

This agenda is undoubtedly very ambitious considering the challenges ahead and the period in which it should be implemented. It consists of plans "integrated and indivisible and balance the three dimensions of sustainable development: the economic, the social and the environmental" (ONU 2015).

According to Ching and Shapiro (2017), the Architecture 2030 group, created in 2002 by architect Edward Mazria, launched the challenge in 2030 that requires all buildings and major renovations consume less than half the amount of energy they consume normally. The Architecture 2030 endorses the reduction in fossil fuel consumption rate by 70% until 2015, 80% until 2020, and 90% until 2025 and ultimately to become carbon neutral in 2030.

Sustainable architecture, according to Ching and Shapiro (2017), should seek not to fall into the trap of new products that promise to be environmentally friendly and sustainable, which are often expensive and inefficient. It is necessary to use common sense to avoid falling into fads, but at the same time, remain open, with a critical eye, always looking to learn new techniques.

What to expect, at last, from a sustainable architecture? According to Ching and Shapiro (2017), the most recognized goals are those wishing to avoid environmental degradation. For that, we need to consider the items shown in Table 1.

Sustainable architecture also stands out health of residents, so it included the improvement of housing conditions through the following objectives presented in Table 2.

Ching and Shapiro (2017) show that the constructions are increasingly evaluated for its environmental efficiency. According to the authors, "the weight of history assessments has begun to fall on the buildings that waste energy. Especially those who claim to be environmentally friendly and sustainable" (p. 11). The authors define sustainable building as one that causes significantly

Awareness of Sustainability Issues, Table 1 Sustainable architecture and its goals

Reduction of global warming, with the reduction of greenhouse effect gases and carbon sequestration processes performed on biological processes. Whereas such biological processes are given by reforestation and recovery of water sources
Minimize the environmental impact by reducing the use of oil and coal and avoiding hydraulic fracturing for the extraction of the natural gas
Reduce the pollution of air, water, and soil
Protect drinking water sources
Reduce light pollution that can harm nocturnal ecosystems
Protect natural habitats and biodiversity, with special attention to endangered species
Avoid unnecessary and irreversible use of agricultural land for use for nonagricultural purposes
Protect topsoil and prevent flooding
Reduce the use of landfills
Reduce the risks generated by nuclear contamination

Source: The authors based on Ching and Shapiro (2017)

Awareness of Sustainability Issues, Table 2 Sustainable architecture, health, and awareness

Improve air quality within the construction environment
Improve the quality of water in buildings
Improve thermal comfort
Reduce noise pollution
Improve the mood of the people who inhabit it
Reduce energy consumption

Source: The authors based on Ching and Shapiro (2017)

reduced impact on the environment and at the same time provides beneficial environments for health.

It should be established for this, a holistic planning, which is to say that the housing project must understand the building and its surroundings and, once observed the surrounding components, plan from the outside in.

The authors also present the operational processes of a building as important elements to be taken into consideration regarding sustainable construction. These operational aspects deal with factors such as heating, cooling, and lighting of buildings, for example.

Therefore, when designing a building, both the materials used and a projection of the proper use and maintenance of such equipment should be thoroughly studied and sized to have the best result in sustainable terms.

The climatic changes that are taking place on the planet have already become evident, and they should also be considered in the development of housing projects, both in relation to risks that they can provide to the building and the opportunities in the use of new more efficient and safe technologies. According to Ching and Shapiro (2017, p. 5), "the field of sustainable architecture is young and offers endless possibilities. There are abundant new opportunities to design and build improving energy efficiency and resources."

For the success of a sustainable project, it is important to know and apply established norms to ensure quality standards in buildings. The certification Leadership in Energy and Environmental Design (LEED) is an example of certification related to sustainable architecture standards. In addition, there is also the Passivhaus, which is a standard that is intended to maximize energy performance of projects and reduce their carbon footprint; the BREEAM considered the oldest seal of certification of sustainable buildings, created in England in 1992; and PROCEL EDIFICA, the Brazilian certification system focused on environmentally responsive buildings and other certifications with similar purposes.

Another important aspect of sustainable construction is the protection of sensitive sites that are represented by arable land, forest parks, areas where floods occur, habitats of endangered species, coastlines, forests with native forests, wetlands and mangroves, and protected areas and water sources. It is also important to consider the waste generated by construction, transportation of materials, due to the emission of pollutants and energy consumption.

In addition, according to Ching and Shapiro (2017), sustainable construction must consider the proper management of rainwater, so that it does not aggravate the risk of flooding, does not lead to pollutants, and avoids soil erosion. The rainwater must have a runoff, which permits filtering, and groundwater supply without being affected by these contaminants.

Sustainable construction should, therefore, assess the environmental conditions within the

environment where they are located, the proper application of natural resources used, and the technologies applied, contemplating the sustainability of both the building as the environment. It should also consider the interaction of the project with all the surroundings and of that with the well-being of the residents, which ensures the application of the holistic concept. So that the awareness of sustainability is widely incorporated into the project and, at the same time, assimilated throughout the production chain.

Final Considerations

From the development of this work, it can be concluded that to consider sustainable housing, it involves understanding that the health of people is directly related to the health of the environment in which they are in. Human beings have to choose the path they want to go from here on. It is necessary to become aware that the current situation is going to be made by permanent choices to be taken as a living species, once there is an interdependence of human life with all that surrounds it. Such choices must come as answers to the challenges posed by the present moment that the planet lives. They should be fruit of the human capacity to incorporate actions that promote real results in terms of sustainability.

Therefore, the lack of care for the environment, the irresponsible production of goods, and the reckless consumption of them generate, in fact, irreversible harm to the human species itself. There are, today, available tools and technologies that enable households to be much more efficient with respect to energy consumption, as well as in issues related to the use of natural resources used in construction. There are also studies that demonstrate the feasibility of recycling and reduce the use of such natural resources to a minimum.

One can understand the construction of sustainable housing as both an enormous challenge as well as an advanced opportunity in human experience in large cities and in other environments where individuals are settled.

Sustainability refers to the idea of continuity regarding the life of human beings on earth, but also considers the care of other life forms. This relationship with the preservation of life and the quality of that experience should always be a starting point to consider in construction projects.

The care with the quality of life of residents involves the concept of holism, the part of the link with the whole, and must be fully observed, since the health of the environment is directly linked to the health of people living in the buildings. Another aspect of holism in construction is on the choice of technical improvements and the use of materials that result in a considerable difference in the building as a whole.

It is, therefore, necessary an effort from everyone (public authorities, architects, engineers, contractors, industry, commerce, civil society in general) so that there is a change of consciousness and that this change decreases the impacts caused by the construction sector in the entire planet. Such a change occurs, of course, from education and dissemination of knowledge able to change the culture of waste so deeply rooted in the most used construction methods.

Cross-References

- ▶ Behavior Change for Sustainable Development
- ▶ Climate Change and Sustainable Development
- ▶ Education for Sustainable Development
- ▶ Energy Management Tools for Sustainability
- ▶ Engineering Education for Sustainable Development
- ▶ Environmental Friendly Products and Sustainable Development
- ▶ Green Labeling and Sustainable Development
- ▶ Green Living Guide and Sustainable Development
- ▶ Green Revolution and Sustainable Development
- ▶ Importance of Sustainability Indicators
- ▶ Innovative Approaches to Learning Sustainable Development
- ▶ Overall Energy Efficiency and Sustainable Development

- Renewable Resources and Sustainable Development
- Social Responsibility and Sustainability
- Strategic Thinking and Sustainable Development
- Sustainability Barriers
- Sustainable Urban Transformation
- Technological Innovation for Sustainability

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