

Building Views on Sustainable Development in Innovation and Design Education.

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Abstract. Higher education has a unique role to play in global sustainability, because it can become an agency for change [1], [2], [3]. It is often discussed that curricula need to be multidisciplinary, and the way we learn needs to be changed in order to solve the complexity of sustainable development [SD] [2], [4]. Innovation and design can humanise and disperse newly considered technologies - and therefore catalyse SD.

This paper will discuss the importance of building a shared view on SD within innovation and design education. This discussion will build on the author's previous research on students' well-being and views, as drivers to become change agents in SD [5]. The paper will explore two models of SD and make a link with disciplinarity in higher education. A comparison will be made between the meanings of innovation and design. The main ingredients of both concepts will be used in the discussion.

Education

The educational system aims to prepare young people for the future, or more specifically, how to cope with potential problems and how to influence their future [1], [6]. Education involves formal and informal learning processes, and participates in how we see the world [7]. Because education prepares for the future, it anticipates on the assumed needs of society. The industrial age has influenced the thinking within and the structure of the educational system [7], [8]. Reductionism and analytical thinking are the main drivers for the learning process, feeding into the industrial age [8]. Higher education can be seen as one of the most advanced stages in the educational system, and prepares future generations of professionals [9].

Sustainability

Environmental and social problems have come to the fore over the last century. As a result, our quality of life [QoL] is facing unprecedented consequences. SD covers the activities to counteract these problems. Institutions of higher education form the main body in society to develop knowledge, and therefore have unique potentials to contribute to SD [10]. However, Orr [6] argues that the people who most influence un-sustainability are the professionals who graduated from higher education.

We can question ourselves as to whether there is something wrong with the worldviews, i.e. the conception of the world, created during higher education - or do students lack vision, i.e. imagination and direction for the future? Note that these are main tasks of education.

As long as students lack core understanding and vision about sustainability, the transition towards a sustainable future will be doubtful [3]. Adaptations in curricula will not be enough, and universities will have to change their learning processes. In order to understand these learning processes, we need to understand how people think about sustainability and what their vision for the future is in order to get there. These questions are specifically of interest for people who will potentially shape our future, i.e. higher education students in courses in design or innovation.

Conception of sustainability?

It is often discussed that SD aims to maintain or enhance the QoL of all people on this planet, living now and in the future. Since there is no overall definition on QoL [11], [12], [13],[14], the author proposes to combine the model of Rauschmayer et al [11], Veenhoven [14] and the Millennium Ecosystem Assessment Board [15] into the model in figure 1 [5].

QoL is about being able to fulfil human needs, i.e. having capabilities and feeling good about this, or well-being. The qualities found in the environment can be seen as outer capabilities, e.g. ecosystems. Qualities found in the individual can be seen as inner capabilities, e.g. state of society [5]. The link between the two constituents is driven by needs and enabled by strategies [11]. Outer well-being indicates that a positive fulfilment of a need creates benefits beyond an individual, and inner well-being indicates an individual's experience. The outer and inner well-being, at a certain point in time, can be seen as the inner capability for a future event.

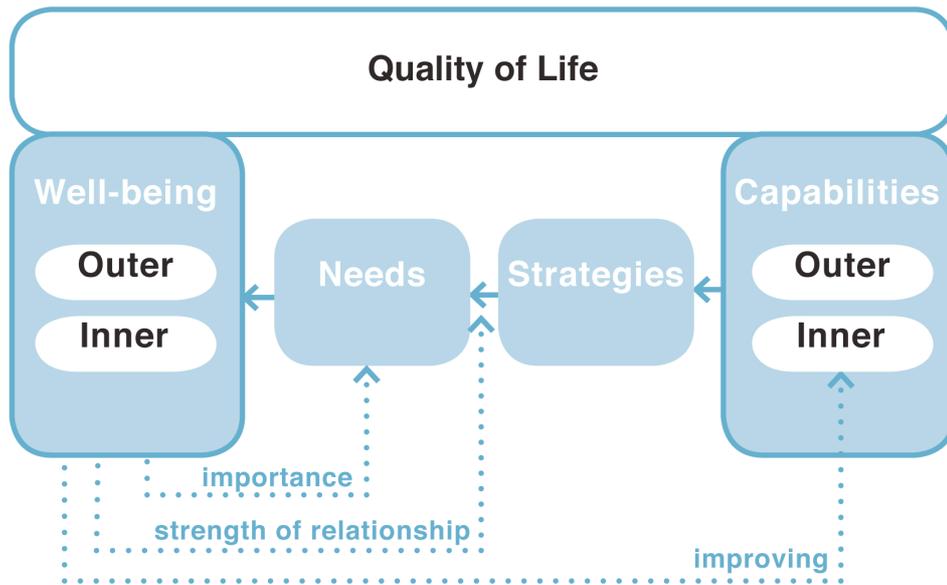


Figure 1: Different aspects to consider when thinking about sustainability [5]

Views on sustainability

Rauschmayer et al [11] argue that people’s views on SD are determined by their beliefs - and more specifically, their beliefs on the importance of different needs and their beliefs to choose a certain strategy to fulfil that need (Figure 1). There are indications that people’s experience of fulfilment of needs will influence their beliefs on the importance of future needs and the strategies, i.e. well-being influences people’s view on SD [5]. Hopwood et al [16] described a map on different views on sustainable development (Figure 2). They consider that people’s views on SD are determined by environmental concerns, and concerns regarding socio-economic well-being and equality. Note that the determinations by Rauschmayer et al [11] and Hopwood et al [16] draw a parallel. More specifically, beliefs to choose a strategy to fulfil a need can be found in capabilities of technology and environmental services. The importance of different needs will indicate someone’s concern that not every person can experience a fulfilling life by only having a fulfilment up to a certain level of needs.

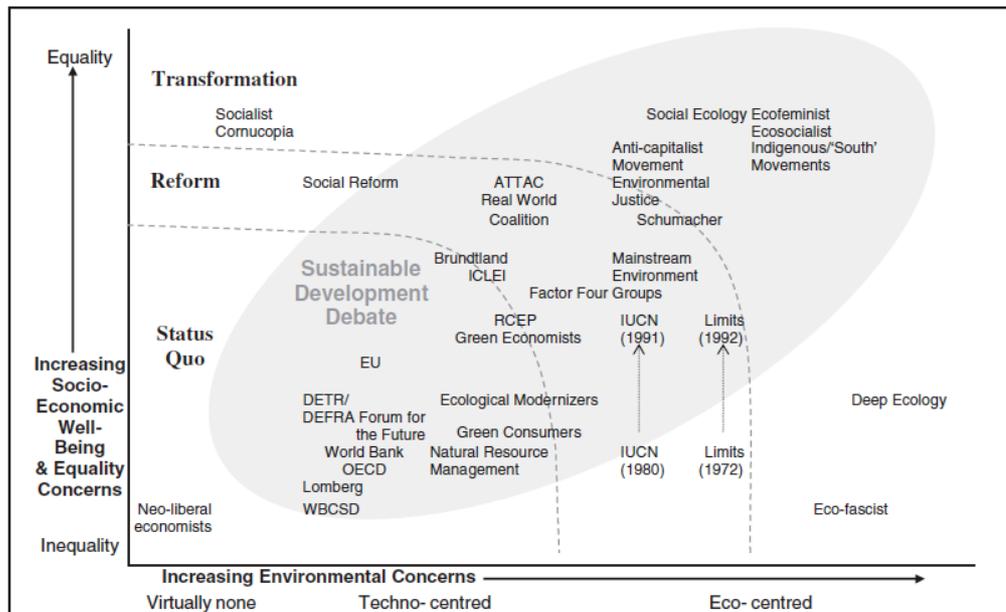


Figure 2: Different views on how to develop a sustainable future [16]

Within the SD debate area (Figure 2), three main approaches can be distilled; Status Quo, reform and transformation [16]. The ‘*Status Quo*’ followers acknowledge the need for change, but see no overwhelming problems facing environment or society. As a result, they see an approach that does not require fundamental changes to society [16]. The ‘*reform*’ group recognises mounting problems. However, in their view, they do not expect a collapse in ecological or social systems, and nor do they see a necessity for fundamental changes [16]. The root of the problem in this approach is seen as the imbalance and lack of knowledge and information [16]. The ‘*transform*’ followers are concerned with mounting problems facing the environment and society. These followers see society and the way that humans interrelate and relate with the environment as the cause of these problems [16].

Sustainability and educational disciplines

Sustainability issues are complex and cannot be understood in isolation; therefore, sustainability challenges reductionists, i.e. the main stream in thinking in the industrial age [9]. Reductionists try to describe the world within the boundary which they call discipline. The model in figure 1 can be interpreted differently according to someone’s ‘discipline’. In addition to this, some disciplines will solely focus on one aspect of the model, e.g. fundamental chemistry, while others will combine multiple aspects, e.g. ecology.

Inter-disciplinarity is a collaborative process which attempts to go beyond the traditional boundaries in order to come up with a solution to a concerned question [9]. Multi-disciplinarity can be seen as the least favourite because it does not consider the relatedness of disciplines. Trans-disciplinarity, on the other hand, is more complex because the research question reaches across several disciplines [9].

The main fields within higher education can be considered as science, humanities and arts. It can be assumed that if higher education includes sustainability in its curriculum, sciences will predominantly focus on capabilities, humanities will focus on needs, and strategies and arts will focus on well-being. Note that this is only an assumption of general trends, and deviations are possible.

Innovation and design for sustainability

An innovation is an idea that is further developed so that it is reliable on a meaningful scale [17]. Often, the context is not yet right to transform an invention into an innovation - and as a result, innovations can come years after the invention. In the contemporary understanding of innovation, the meaningful scale is often considered, as within an economic market. In order to reach a meaningful scale, knowledge from different fields needs to be combined [17]. This knowledge also includes tacit knowledge, i.e. intangible knowledge derived from experience of actions and interactions in a certain context [18]. Traditionally, this means that in order to innovate, people from different disciplines need to collaborate to develop new knowledge, and this process is called organisational learning [17], [18]. Innovation is key in SD because it can spread out necessary changes. One of the problems why higher education is not proactive enough in SD is that higher education is over emphasising individual learning and not enough organisational learning [19].

Design can be seen as the link between technology and humans. Designers are often considered as creative thinkers. Creativity might, for some people, indicate chaos and serendipity; however, designers follow a process. During this process, designers learn and use a thinking pattern which is different to analytical or linear thinking. Designers explore multiple solutions and are not afraid to iterate parts of the process. This learning process is often called design thinking. Designers follow this process because they need to make trade-offs between multidisciplinary requirements. In this way, a designer has the capacity to build different scenarios concerning different parameters, ranging across marketing, manufacturing (from material selection until distribution), aesthetics, ergonomics, etc. Design thinking also includes coping with uncertainty and ambiguity in order to be able to further explore new directions and come up with unexpected solutions. Designers have unique potentials for SD because their work creates novel ideas and considers all aspects of QoL. This work is driven by human needs, evaluated by people's well-being and enabled by capabilities (Figure 1).

The application of design in a company can range from no design, to design as applying style, to design as part of the process, to eventually design as the key part to encourage innovation [20]. We can say that the boundary between innovation and design is getting smaller and smaller. Maybe, the main difference between the two could be that innovation focuses on quantity of knowledge, whereas design focuses on quantity of ideas in order to come up with qualitative and effective solutions. Both concepts need each other in SD because design can bring new novel and sustainable ideas into the world and innovation can spread these ideas into society.

Discussion

Inter-disciplinary and trans-disciplinary work are key ingredients for SD. It is clear that if institutes of higher education will include these ingredients, they will become learning organisations. According to Senge [17], a shared vision provides the learning organisation with focus and energy, and triggers generative learning - i.e. expanding your ability to create, because individuals get excited about a vision they want to accomplish [17]. A shared vision in its most basic form is an answer to the question “what do we want to create?” In this study, this paper will use the term ‘view’ instead of ‘vision’. We consider a view as a broader concept of beliefs that can facilitate similar visions.

However, how do we prepare students for future work in learning organisations on SD? We discussed earlier that there is a diversity of views on SD. Despite a lack of research, we can suggest a correlation exists between an educational ‘discipline’ and the common view on SD within this ‘discipline’. The reason for this is that higher education should provide direction for the future, and these directions will be influenced by different needs expressed by the respective discipline. If every educational ‘discipline’ educates according to its own preferred shared view and graduates settle in learning organisations, we can expect frustrations and stress in the learning organisation - and as result, expect delays in the innovation process. The reason for this is that graduates will assume they have similar conceptions on SD, misunderstandings will occur, and clashes in levels of ambitions can be expected.

Within a corporate team, designers are often the only ones who can speak all the jargon [21], and often function as the bridge between disciplines. So, how can design students be prepared for facilitating a learning organisation for SD?

Diversity offers a huge opportunity for sharing and creation of knowledge, but on the other hand, challenges the creation of a common understanding [22]. Fisher [22] points out two different types of ‘groups of designers’ - i.e. ‘communities of practice’ and ‘communities of interests’ [22]. The challenge for communities of interest is the creation of a shared understanding [22]. Communities of practice have a single knowledge system, i.e. the source of information is shared within the community [22]. Communities of interest differ from this by combining diverse knowledge sources, and in this way, every contributor can be an ‘expert’ as well as a ‘novice’ regarding which direction the discussion flows [22]. The challenge for communities of interest is the creation of a shared understanding [22].

It is clear that creating a shared understanding is not a static process. The Perry scheme (Table 1) is a framework to provide guidance in how design thinking grows during the learning process [23]. Despite the Perry scheme being developed to measure development in students’ performance, we can learn some trends for learning organisations. The Perry scheme suggests shifts in criteria are key in a development process, and four main stages can be distinguished: dualism, multiplicity, contextual relativism and commitment in relativism, see table 1 [23]. In the context of this discussion, we can argue that in order for designers to guide a learning organisation in building a shared vision, they need to ensure every member of the learning organisation moves away from dualistic thinking towards multiplicity, or preferably

contextual relativism. The reason for this is that during an inter-disciplinary process on SD, an answer to a question will not range over the different disciplines, but will need to be found by a combination of disciplines. Commitment in relativism could be seen as having a shared vision. The reason for this is that personal choices and commitment are made, and personal experiences will strengthen the drive to make changes.

Table 1: Perry scheme of intellectual development [24]

	<i>Dualism</i>	<i>Multiplicity</i>	<i>Contextual relativism</i>	<i>Commitment in relativism</i>
View of knowledge	View of truth as absolute. Right and wrong answers exist for all questions.	Legitimate uncertainty exists. Non-arbitrary basis for determining what's rights.	Knowledge is contextually bound, few right/wrong answers exist.	Knowledge shifts from intellectual to ethical.
View of the role of the instructor	An authority figure exists who gives knowledge to the student.	Authority figure may not know all the truths in its own domain.	Serve as experts that help guide the student.	Knowledge given is integrated with personal experiences.
View of the role of the student	Hard work and obedience are expected.	Learning focused on process and methodology.	Questioning of judgment and meaning-making in academic contexts.	Personal choices and commitments are made.

However, are design courses the cornerstone for SD in higher education? Sterling [24] argues that besides a vision, education needs to oppose an image and design. In this framework, a vision includes a philosophy and direction; an image of a desired state includes core values, and design includes strategies to realise this image. Building on this argument, we can assume that design thinking can be brought to every student, regardless of the discipline. "Gestaltungskompetenz" is a German concept applied in higher education [25]. This concept helps to express learners' qualities, competencies and attributes when they need to exchange thoughts on sustainability issues. It includes forward thinking and strategies to modify and model the future society. Building on this argument, we can assume that *gestaltungskompetenz* could be the means for building a shared vision on SD.

Conclusion

Innovation and design are two concepts, the meanings of which are close to merging. Both are paramount in SD and should be thought of in this context by higher education. Inter-disciplinary work and organisational learning are means to change the way in which higher education operates in order to build on SD.

Designers do have a unique potential to become facilitators of organisational learning. The key role in this facilitation process is to build a shared view on SD. Therefore, design students should be taught the different views. Design students should also be taught the stages that people go through in shifting criteria during the learning process. Higher education can also prepare other disciplines for SD by providing the students with capabilities to operate in learning organisations.

References

- [1] J.C. Stephens, M.E. Hernandez, M. Román, A.C. Graham, and R.W. Scholz, “Higher education as a change agent for sustainability in different cultures and contexts,” *International Journal of Sustainability in Higher Education*, vol. 9, 2008, pp. 317-338.
- [2] G. Steiner and A. Posch, “Higher education for sustainability by means of transdisciplinary case studies: an innovative approach for solving complex, real-world problems,” *Journal of Cleaner Production*, vol. 14, 2006, pp. 877-890.
- [3] D. Tilbury, “Rising to the Challenge: Education for Sustainability in Australia,” *Australian Journal of Environmental Education*, vol. 20, 2004, p. 103.
- [4] M. Levin, D. Greenwood, P. Reason, and H. Bradbury, “Pragmatic action research and the struggle to transform universities into learning communities,” *Handbook of action research: participative inquiry and practice*, SAGE, 2001.
- [5] M. Claes, “Students’ well-being and views as drivers to become change agents in sustainable development,” Cranfield University, 2009.
- [6] D. Orr, “Foreword,” *Sustainable education : re-visioning learning and change (S. Sterling, and E.F. Schumacher Society, Editors)*, Totnes: Green Books for the Schumacher Society, 2001.
- [7] P.M. Senge, N.H. Cambron-McCabe, T. Lucas, B. Smith, J. Dutton, and A. Kleiner, *Schools That Learn: A Fieldbook for Teachers, Administrators, Parents and Everyone Who Cares About Education*, Nicholas Brealey Publishing, 2000.
- [8] D.H. Pink, *A Whole New Mind: Why Right-brainers Will Rule the Future*, Riverhead Books, U.S., 2006.
- [9] P. Jones, D. Selby, and S. Sterling, “More than the sum of their parts? Interdisciplinarity and sustainability.,” *Sustainability Education: Perspectives and Practice Across Higher Education*, Earthscan Ltd, 2010.
- [10] P. Albrecht, S. Burandt, and S. Schaltegger, “Do sustainability projects stimulate organizational learning in universities?,” *International Journal of Sustainability in Higher Education*, vol. 8, 2007, pp. 403-415.
- [11] F. Rauschmayer, I. Omann, J. Frühmann, and L. Bohunovsky, “What about needs? – Re-conceptualising Sustainable Development,” 2008.
- [12] R. Costanza, B. Fisher, S. Ali, C. Beer, L. Bond, R. Boumans, N. Danigelis, J. Dickinson, C. Elliott, and J. Farley, “Quality of life: An approach integrating opportunities, human needs, and subjective well-being,” *Ecological Economics*, vol. 61, 2007, pp. 267-276.
- [13] E. Diener, “Introduction-The Science of Well-Being: Reviews and Theoretical Articles,” *The Science of Well-Being*, Springer, Springer, 2009.

- [14] R. Veenhoven, "The four qualities of life: Ordering concepts and measures of the good life," *Understanding human well-being*, Tokyo ;;New York: United Nations University Press, 2006.
- [15] Millennium Ecosystem Assessment (Program), *Ecosystems and human well-being : synthesis*, Washington DC: Island Press, 2005.
- [16] B. Hopwood, M. Mellor, and G. O'Brien, "Sustainable development: mapping different approaches," *Sustainable Development*, vol. 13, 2005, pp. 38-52.
- [17] P.M. Senge, *The Fifth Discipline*, Random House Books, 2006.
- [18] R. dePaula, G. Fisher, J. Davis, E. Subrahmanian, and A. Westerberg, Eds., "Knowledge Management: Why Learning from the Past Is Not Enough!," *Knowledge Management*, Heidelberg: Physica-Verlag, 2005.
- [19] P. Albrecht, S. Burandt, and S. Schaltegger, "Do sustainability projects stimulate organizational learning in universities?," *International Journal of Sustainability in Higher Education*, vol. 8, 2007, pp. 403-415.
- [20] G. Raulik-Murphy,, A. Whicher, and G. Cawood, "SEE bulletin Issue 1 : The design ladder," Aug. 2009.
- [21] V. Papanek, *Design for the real world : human ecology and social change*, London: Thames and Hudson, 1985.
- [22] G. Fischer, "Distances and diversity: Sources for social creativity," *Creativity and Cognition Proceedings 2005*, 2005, pp. 128-136.
- [23] C. Carmel-Gilfilen and M. Portillo, "Developmental trajectories in design thinking: an examination of criteria," *Design Studies*, vol. 31, 2010, pp. 74-91.
- [24] S. Sterling and E.F. Schumacher Society., *Sustainable education : re-visioning learning and change*, Totnes: Green Books for the Schumacher Society, 2001.
- [25] A.E. Wals and J. Blewitt, "Third-ware sustainability in higher education: Some (inter)national trends and developments," *Sustainability Education: Perspectives and Practice Across Higher Education (P. Jones, D. Selby, and S. Sterling, Editors)*, Earthscan Ltd, 2010.