Developing sustainability competence and 21st Century capacities through Transformative Agricultural Education

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Developing sustainability competence and 21st Century capacities through Transformative Agricultural Education

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We live in turbulent times, our world is changing at accelerating speed. Information is everywhere, but wisdom appears in short supply when trying to address key interrelated challenges of our time such as: runaway climate change, the loss of biodiversity, the depletion of natural resources, the on-going homogenization of culture, and rising inequity. Living in such times has implications for education and learning (Wals and Corcoran, 2012).

The introductory quote comes from one of the latest books on education and learning in the context of sustainable development that I was privileged to co-edit with Peter Blaze Corcoran – *Learning for Sustainability in Times of Accelerating Change* (Wals and Corcoran, 2012). There is a widespread consensus that the speed of change, physically, socially and culturally, is accelerating. Continued globalization and digitalization are not only affecting how we think, what we know, who to believe, how we act, they also affect the role of education in society. Higher education, for instance, and the science it produces, is no longer the sole authority of truth, if ever it was. Rather, science oftentimes has been downgrade to just another point of view or an opinion in the public debate of controversial and ambiguous issues such as the causes and impacts of climate change, the role of GMOs in food security, the use of biofuels as a 'sustainable' source of energy, and so on. Scientists can be found on different ends of the ongoing debates, although more might be found at one end than on the other. It is not easy to decide who is right, who is wrong, or who is more right than others, or what the best way to move forward might be. This poses challenges, not just for policy-makers or entrepreneurs, but also for educators. After all, what do we educate for in such a world when things change so fast and knowledge becomes obsolete before you know it? How do we prepare today's graduate for the world of tomorrow? And more specifically, what are the implications for tertiary agricultural education (TAE) around the world?

In this contribution I will highlight an emerging world-wide response that entails a shift from traditional transmissive (based on the transfer of static knowledge from a sending teacher to a receiving learner) to emerging transformative (based on the development of more dynamic competencies in real-world settings based on authentic tasks and issues that require knowledge-in-action) forms of education which we will refer to as 'competence-based' (Mulder, 2012)[1].

[1] See, for a review of the literature on the concept of competence and of the current understanding of professional competence as situated expertise, Mulder (2014). Conceptions of professional competence. Billett, S., Harteis, C. and Gruber, H. (Editors). *International Handbook on Research into Professional and Practice-Based Learning*. Frankfurt, Germany: Springer.

Compared to ten years ago, TAE is more in demand today because of an increased interest in quality-of-life issues, including amongst young people. Issues such as climate change and related worldwide weather-related disasters, the end of peak oil and the search for alternatives, feeding the world and related food-security issues and emerging transitions towards a bio-based economy, circular economies, urban agriculture and sustainable consumption and production, have led to a more prominent place for TAE in the world of higher education. At the same time, agricultural universities started changing their identity by positioning themselves as *life science universities*, while vocational agricultural schools nowadays are often referring to themselves as 'green education institutions' which all aspire to contribute to a better world and improved quality of life.

Clearly the new dynamic in our interlinked world and the new demands and needs that arise from the challenges of creating and supporting developments that are more sustainable than the ones currently employed, requires a number of new competencies. These include; interdisciplinary problem-solving, addressing multiple stakeholder interests, participatory approaches in innovation, interactive methods in conflict resolution, responsive actions regarding community needs, critical media literacy, and social responsibility in entrepreneurship, to name a few, along with those that still connect to specific content areas (e.g. animal science, plant science, environmental science and agro-technology). Relatively new is the notion of sustainability competences (e.g. Wiek *et al.*, 2011; Barth *et al.*, 2007) or sustain "abilities" which add another educational challenge (Table 1).

Table 1. Dimensions of sustainability competence and associated sustain-abilities

Sustainability competence	Examples of sustain-abilities
Dynamics and content of sustainability	• Sustainability literacy • Systems thinking • Adopting an integral view
Critical dimension of sustainability	• Questioning hegemony and routines • Analysing normativity • Disruptiveness, transgression
Change and innovation dimension of sustainability	• Leadership and entrepreneurship • Unlocking creativity, utilizing diversity • Appreciating chaos & complexity • Adaptation, resilience • Empowerment and collective change
Existential and normative dimension of sustainability	• Connecting with people, places and other species • Passion, values and meaning-making • Moral positioning, considering ethics

The competences listed in Table 1 are particularly necessary when seeking to approach the sustainability challenges of our time more holistically, critically, ethically and existentially. If we take food and nutrition security, for example, then we can conclude that most life science schools and universities will have programs addressing aspects of food and nutrition security with the occasional interlinkages, but very few are able to offer an integrative approach that transcends disciplines and sectorial boundaries. This is no surprise of course as our education systems by and large are rooted in a Cartesian view of the world which suggests a reductionist ontology and an empirical analytical epistemology (Peters and Wals, 2013). In a sense one can say, the more educated we become the better we get at thinking the world into pieces and seeing the parts but losing the ability to see relationships, interdependencies and wholes. While the former has brought us much technological progress and improved the quality of life for many, the latter will be needed to deal with the 'wicked' issues that can be considered undesirable 'by-products' of

the former (e.g. loss of biodiversity, climate change, micro-plastics in soils, water ways and, indeed, bodies). If we try to look at food and nutrition more holistically, for instance, it would require all the "abilities" listed in Table 1 and probably a few more. If we would just consider the content more holistically it may look like Fig. 1 or Fig. 2 below.

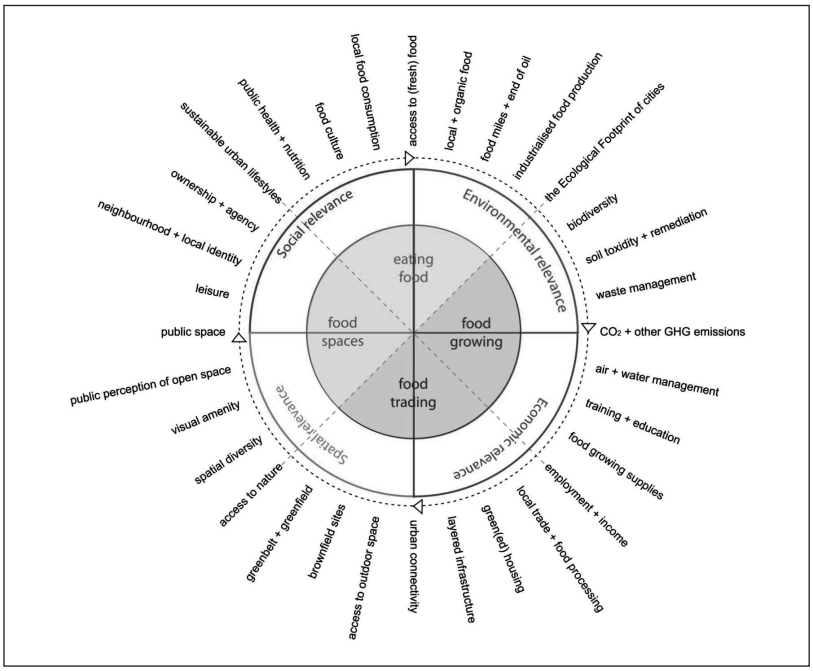

Fig. 1. An effort to consider food more holistically (Viljoen and Wiskerke, 2012).

Figure 2 represent another way of approaching food security in a more holistic way but from another vantage point which is just to illustrate that there is no one way of looking in more integrative ways at complex issues.

Unlike Fig. 1, Fig. 2 also includes the mechanisms that can be used to influence such complex systems: education, research, governance, (chain) management and entrepreneurship.

Figure 2 also illuminates the hybrid playing field of actors engaged in the food and nutrition security and the broader sustainable development domain. Institutions of education and research need to find a position within that playing-field: sometimes playing the role of "innovation broker", sometimes one of provider of certain expertise, sometimes as a source of capacity-building and professional development and sometimes as a bridge between interests and perspectives.

Clearly making agricultural education more responsive to the challenges of the 21st Century is more than just linking up the content of the curriculum to sustainability issues like climate change and food and nutrition security; it also involves developing new competencies such as dealing with complexity, uncertainty and confusion, and devising and implementing meaningful local solutions often with the support of local (vocational) schools and universities. Governments will have to put more effort into stimulating and supporting the 'hybrid teaching environments' or 'learning ecologies' that blur the boundaries between science and society, school and neighbourhood,

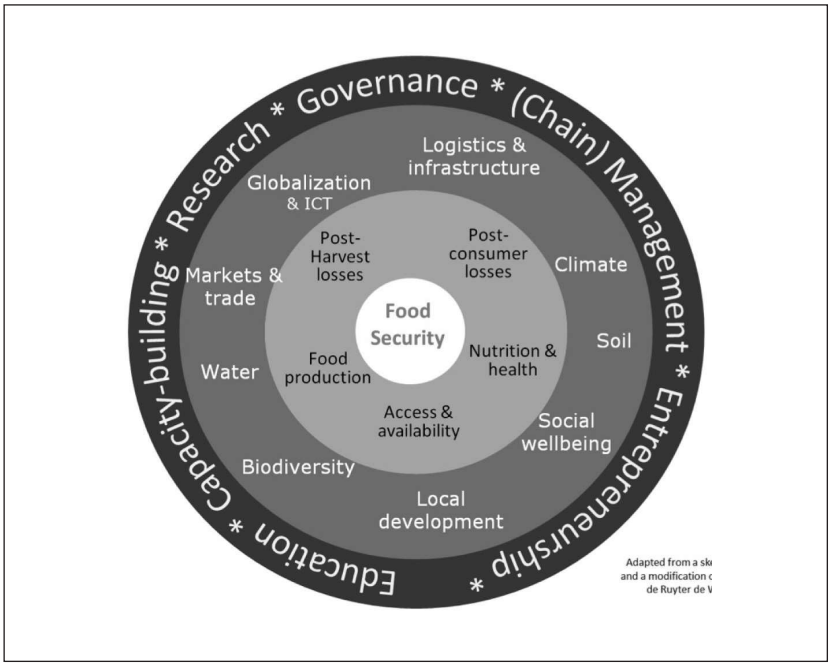

Fig. 2. Food Security: topics, contexts and processes.

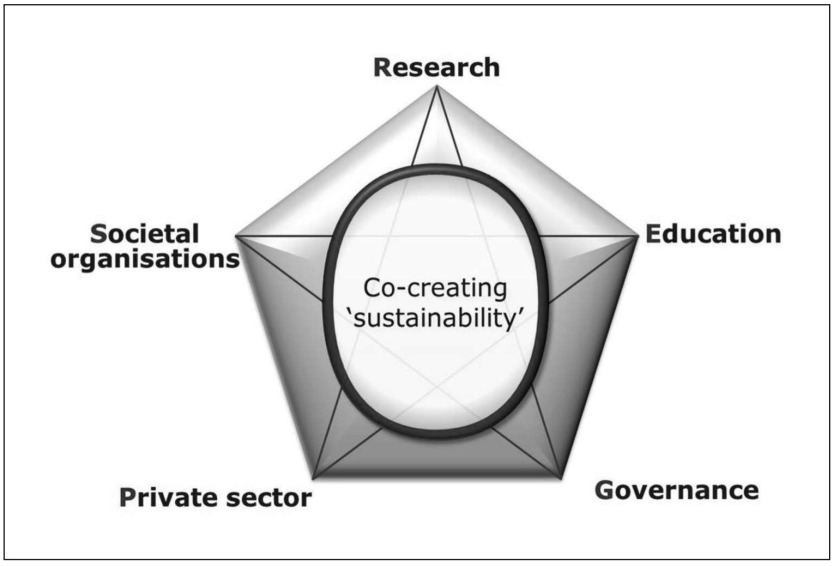

Fig. 3. The 'diamond five' playing field where knowledge about wicked sustainability issues is co-created.

local and global, and shift the emphasis to the wellbeing of mankind and the planet (Fig. 4). The model shown in Fig. 4 shows many elements of what we might call 21st Century education: recognizing the different lenses learners/stakeholder bring to the learning arena, considering the role of (social) media, technology and language in learning, recognizing multiple dimensions of learning from learning for knowing to learning for 'being' and learning to make change, but also acknowledging that education is more that understanding data and acquiring knowledge as it also must be about meaning, understanding and, ultimately wisdom. A learning ecology also suggest that formal, informal, community-based learning, self-learning, apprenticeship learning, ICT-supported learning, all takes place simultaneously in multiple contexts (home, school, workplace, smartphone, etc.). Governments also need to make sure that schools and universities can participate in these arrangements, while schools and universities need to prepare their staff and students for functioning and developing within such arrangements.

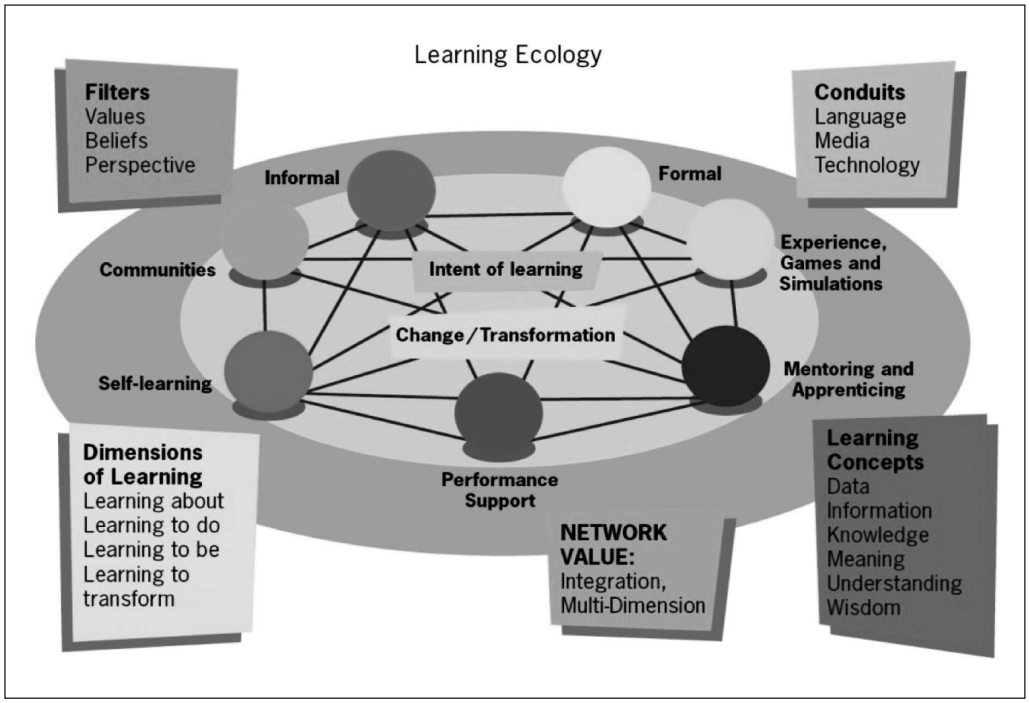

Fig. 4. Creating ecologies of learning (Source: George Siemens, 2005).

Staying closer to 'just' formal education, there will be a need to develop a new didactical orientation which we might dub "sustainability didactics". Sustainability didactics refers to teaching and learning, and the design of learning environments or spaces, that enables learners: to see the world more holistically, to see the local manifestations of global phenomena but also the global manifestations of their own choices and actions, to consider different time perspectives, past-present-future but also to consider short and long term effects, to help them understand systems and systems dynamics, to help them deal with complexity and uncertainty, not with the aim of to reducing them but rather with the aim of making it generative for reflection and continuous learning, and, to engage learners in change and transformation to move beyond awareness and the threat of paralysis by becoming overwhelmed.

Conclusions

The public has various expectations on a multitude of issues in the fields of agri-food production, environment, landscape and the management of natural resources. New competencies are needed for graduates to meet the challenges of a rapidly changing world with diverse societal demands and tightening ecological boundaries. Agricultural educational institutes will need to engage with the new competencies needed and the learning ecologies that are currently being formed around the key issues of our time, many of which are connected to the field of agriculture.

Traditional educational innovation trajectories (based on needs assessment, curriculum design, instructional design, implementation and evaluation) are not sufficient to reorient TAE towards the direction needed within the prevailing global change dynamics. These trajectories take too long because of their inherent time lag of many years. Clear values regarding the content-related issues together with an appropriate educational philosophy are imperative. As Wals and Bawden already wrote in 2000 such a philosophy will require an educational orientation from:

- Consumptive learning to discovery learning in open-source environments
- Teacher-centred to learner-centred arrangements
- Individual learning to collaborative learning
- Theory dominated learning to praxis-oriented learning
- Sheer knowledge accumulation to problematic issue orientation
- Content-oriented learning to self-regulative learning
- Institutional staff-based learning to learning with and from outsiders
- Low level cognitive learning to higher level cognitive learning

In the future, universities and vocational learning institutions, whether they are framed as “agricultural”, “green” or “life-science” who are able to rethink their educational philosophy and their relation with society will be given greater recognition as leaders in society where cutting edge new knowledge is generated. They will constantly question and reform deeply entrenched unsustainable routines, structures and practices and engage in collaborative endeavour in continuously seeking to preserve people and planet, where the economy is a means, not an end. Finally, the educational institutions themselves and the community of which they are part will have to mimic the kind of sustainable practices they seek to promote in its research and education in the way it runs its own business. The University of the Future lives and learns by example. Failing to do so will widen the gap between rhetoric and reality and further undermine the credibility of education and research.

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