Dealing with Climate Change as a Wicked Issue via Innovative Approaches

Dz. Iliško and O. Dedels

Abstract As this is stressed in the international legislation and research, climate change is a serious global problem that has a negative impact on the quality of life which needs solutions at both global and local levels. The chapter reflects on good practice of integrating innovative pedagogical approaches dealing with a climate change as a complex and wicked issue in a blended university study course: "*Educating for sustainable social and cultural changes*" at the Master's program level. The course is carried out at a regional University and highlights a promising practice of engaging students as transformative actors in their local contexts for initiating sustainable changes. It was concluded that the climate change issue needs to be dealt with as a wicked problem within a sustainability framework, and it needs to become an integral part of learning for a sustainable development. By learning about climate change, students acquired not only knowledge but they developed competencies to adopt sustainable lifestyles leading to a climate-resilient and sustainable behavior. The authors believe that a sustainable development requires changes in the way people think and act, and they see education playing a critical role in teaching relevant skills for the application of change in this issue.

Keywords Complexity · A wicked issue · Blended course · Innovative pedagogical approaches · Trans-disciplinarity

Climate Change as a Wicked Issue Within a Sustainability Discourse

Sustainability issues are linked to each other and need to be seen at the intersection of social and natural systems. Climate change as a complex issue also lies at the intersection of many disciplines and involves numerous ethical and values aspects. Climate change consequences are far-reaching and unpredictable. Expert knowledge

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is partial and uncertain and is lacking agreement in terms of solutions while dealing with climate change, therefore it requires systematic thinking. Because of the incomplete understanding of how climate change affects socio-ecological systems, fluctuation processes, severity magnitude and the impacts on the planet, resilience is necessary for the flexible adaptation to changing circumstances without losing reliability (Duitt and Galaz 2008). As Aldunce et al. (2015) assert, climate change poses a real problem and requires building resilience and adaptation. This requires a collaboration of all actors involved: policy makers, cities, scientists and NGO's in co-producing knowledge based on their experience. This would lead to a more efficient and systemic governance of socio-ecological systems.

Climate change as compared to other environmental problems involves uncertainty, complexity and numerous ethical considerations since the nature and the scope of this issue is highly contested (Giddens 2009; Hulme 2009). Climate change as a "wicked" issue is characterized with high levels of complexity, ambiguity, and uncertainty, and dealing with it requires the use of innovative approaches. Complex issues are vaguely defined and cannot be understood without knowing the context. Wicked issues cannot be solved by conventional strategies that require clear objectives, rational planning and well-defined solutions. A simple and reductionist approach cannot be used in approaching wicked issues.

Considering the complex nature of climate change, education needs to play a significant role in initiating reflection and discussion in order to provide a way to imaginative solutions and a diverse dialogue accompanied by a synergetic way of exploring the issue. Denying or ignoring the complexity of the issue will bring new types of problems. Students need to learn to embrace and to deal with this complexity by seeking connections. They need to perceive themselves not as being outside this complexity but as the ones who are able to shape a better world by asking questions, expressing willingness for action and acknowledging themselves as a part of this complexity. This will help them to accept ethical obligation in dealing with this and similar issues. The complex issues have no clear solutions. Instead, the course facilitators used a system approach to understand the climate change issue in a broader way. Holling (2001) asserts that complex issues need to be examined through the adaptive systems in a perspective that requires a consensus-based decision-making of multiple stakeholders. Dealing with wicked issues requires learning how to deal with change, uncertainty, thus finding the sources of resilience. Work with complex issues requires systematic thinking that includes future envisioning, contextualization, critical thinking, decision-making capacity, a dialogue across and between disciplines and adapting sustainable behavior (Tilbury and Wortman 2004; Tilbury 2011).

As a complex issue, climate change cannot be resolved within the dominant models of thinking and conventional governance approaches. It needs different approaches and different perspectives while maintaining openness to a plurality of perspectives and differences. This requires a reflexive and dialogical process where students articulate their personal worldviews and share them with others. Termeer et al. (2015) asserts that dealing with wicked issues require understanding of one's limited understanding, sensitivity to its complexity and multiple perspectives in

dealing with each issue. Besides, these issues cannot be solved completely but require one to live with them or even to embrace each one (Xiang 2013).

Interdisciplinarity Framework for Dealing with Wicked Issues

Because of complexity, each climate change issue cannot be solved from a single discipline perspective but rather by transcending boundaries and reaching beyond and between disciplines. This requires establishing a common ground among the stakeholders from various disciplines leading to 'transdisciplinary syntheses' or 'multi-domain ontologies' (Wiener, in Madni 2007). Therefore, dealing with climate change requires different strategies from the ones offered by traditional science. Transdisciplinarity is seen as a key for dealing with the issues such as climate change by many scientists (Clark and Button 2011; Weinberger 2011). Clark and Button (2011) suggest that transdisciplinarity involves imagination, innovative thinking, thinking outside the borders of traditional disciplines. This involves the encounter of paradoxes, the ability to think in a complex way, the integration of knowledge from various disciplines, involving multiple stakeholders in dialogue. As Weinberger (2011) argues, that dealing with wicked issues requires post-epistemological conceptual framework and a collaboration of stakeholders outside the academic field. The complexity of the climate change issue blurs the boundaries between the responsibilities for dealing with it. By discussing real world issues with the involvement of multiple stakeholders, one opens the space for epistemological pluralism, system thinking and resilient thinking (Krasny et al. 2011). By educating students to play a meaningful role in shaping their future, we develop their capacity to shape their future.

The Progress Made so Far

The issue of climate change has been the center of attention in international legislation for two decades when it was addressed by *the United Nations Framework Convention on Climate Change* (UNFCCC) (1992). Since then, climate change has become an issue for discussion in forums, public debates, and school curricula. By summarizing existing research on a planetary state of being, Anderson and Strecker (2012) concluded that climate change still remains a serious problem and one can notice even a reverse progress towards meeting the Millennium Developmental goals (MDGS). The United Nations Decade of Education for Sustainable Development (2005–2014) has also played its significant role in integrating principles, values and practices of sustainable development in educational courses. New Sustainable Development Goals' (SDGs) framework, post-2015 agenda, and Global

Action Plan (GAP) (2014) present a promise for dealing with major global challenges, including the climate change issue. As this is reported in a number of significant documents, education is the most effective means for solving the issues we are confronted today (UNESCO 2014). To deal with the challenges of the 21st century, we need new thinking and innovative pedagogical approaches to address contemporary ecological and societal issues in their complexity.

By designing future strategies for action, several documents, such as UNFCCC (1992), Agenda 21 and GAP (2014) have identified youth as particularly significant players in shaping a sustainable future. Since the climate change issue is a multi-scale issue, the documents stress the need to integrate climate change education in teacher training programs, thus empowering and engaging youth to implement decisions set in the strategic documents on climate change. Therefore, any university's educational environment is favorable for implementing those initiatives set in the significant local and international strategic documents. Many publications on climate change provide examples of youth acting as agents of change in their local communities. Youth can develop leadership skills to participate in the decision making processes at national and international levels and play a role of educating their peers and building capacity and advocacy, initiating new projects and building strong resilience to climate risks for further generations. The Lawier and Patel (2012) study reports that youth play a significant role as advocates in helping their families, schools and communities to look for solutions for climate change.

The Rationale of the Course: The Case Study

The course was designed as a blended course composed of classroom and e-learning modules. Among the modules the authors included an e-learning climate change module, followed by discussions and reflections during regular classes. The main focus of the course is on expanding students' understanding of interconnectedness between all aspects of sustainability: political, economic, environmental, social, and culture.

The course focuses on developing students' basic understanding of scientific concepts, certainties, uncertainties, risks and consequences of environmental degradation, climate change and how those issues contribute to an unsustainable state of being of the planet. Considerable attention is paid to the issues linked to climate change such as a well-being, greenhouse effect, impacts of a climate change, adaptive governance, and carbon footprint calculation. This as well as other modules of the Open Online Course (MOOC) on the Ecosystem Approach and Systems Thinking (EAST) developed by the Loyola Sustainability Research Centre at Concordia University, Montreal, and the United Nations Environment Program (UNEP) in Nairobi, Kenya have been integrated in the Master's study course on a voluntary basis. The Climate change module in this course focuses on climate change as viewed via the social-ecological framework and the systematic thinking approach (EAST).

The students were invited to work in heterogeneous teams that allowed various perspectives to co-exist. The course participants were students from the fields of education, culture studies, environmental studies and the IT field. They were working together on a specific issue in a blended learning environment. They identified problems related to climate change in an interdisciplinary dialogue and worked together on developing solutions. Inter-disciplinarity served to encourage reflection and interdisciplinary collaboration. Dealing with complicated issues required them to use creativity, flexibility, problem solving, shared intelligence, and risk-taking.

The students were offered a wide range of web-based resources that supported exploration of a diverse range of issues in relation to climate change and this was aimed at developing competency to evaluate resources and to apply critical thinking in processing information.

Methodology

The research methods used for data collection were pre-course survey on students' understanding of sustainability challenges and how they relate sustainability to their individual lifestyles and how their actions can contribute to the climate change issue (n = 39).

After completing the course, the students were asked to reflect in their essays on their learnings during this course. The analyses of essays (n = 39) had a focus of a holistic view of a learner, particularly of all domains of learning, such as: cognitive, affective, attitudinal and behavioral aspects of learning leading to making a positive contribution to other people and their social and natural environment, locally and globally. It was aimed at gaining feedback about what students learned in a blended course design. Its aim was to focus on the developing students' competencies to deal with unsustainability and\ a climate change as a wicked issue. The other method employed in this study was focus group discussion after the students completed the course. The aim of the focus group interviews was to identify changes in students' cognitive, attitudinal, value and behavior aspects with the regard to environmental issues.

Research Findings

The course has its **transdisciplinary character**. The participants of this educational course were the students representing different fields of science, therefore they contributed to the debate by the specific knowledge from their field of study. They analyzed the issue by synthesizing information from various disciplines: from the physical, natural, and social sciences (n = 39). During the course the students have learned about the interconnectedness between climate change, economic matters,

and social justice discourse. Students also became aware of the multifaceted impact of climate change in its diverse forms: social impact (health issues, poetry, migration of environmental refugees, conflicts over limited resources); economic impacts (negative impact on agriculture, changes in expiration patterns), and environmental impact (melting of polar caps, droughts, loss of biodiversity). The blended module of the course on climate change was aimed at developing students' understanding of how this issue is interlinked with such considerations as economic growth, environmental degradation and poverty reduction.

Within the context of reform processes in Latvia, the course authors set the aim to develop ESD competencies. For the graduates to be competent of problem solving in sustainability, they need to acquire competencies that are necessary to analyze sustainability problems systematically and to act upon those issues in order to reach sustainable solutions. Innovative aspects of this course highlighted the integrating of real-world sustainability issues like climate change, through combining formal curriculum and informal e-learning environment. The authors of this research believe that educational programs should focus on preparing students as "systemic problem solvers and change agents" (Wiek et al. 2011, p. 204) (Table 1).

Pre-course Survey

The data gained from the preliminary course survey indicates that students have a lack of understanding about how their actions can contribute to climate change and a lack of information about the issues at a local level. Almost all students stated that

Table 1 ESD competencies defined prior implementing the course

Competencies	Sub-categories
Transversal competencies	Promoting individual and collective responsibility
	Working with different and controversial perspectives
	Welcoming transdisciplinary discourse
	Seeing the interconnectedness of all sustainability aspects
ESD competencies	Developing critical thinking
	Promoting a sense of belonging to the environment
	Participate meaningfully in decision making processes
	Exercising the right and the responsibility as citizens within a democratic society
Science education competencies	Exploring phenomena scientifically by providing scientific explanations
	Identifying causes of climate change
	Analyzing the impact of human activities on the environment
	Analyzing controversial theories

Adopted from Cebrian and Junyent (2015)

environmental degradation is one of the most challenging global issues. Many students reported that they are now informed about action being taken. The students of this course have an interest in climate change issue and they consider it to be an essential component in their studies.

Pre-course survey indicates that 80% of students believed that global warming is a real problem as recognized the consequences of it. 65% of students identified the link between carbon emission and global warming. 67% believe that recycling, the use of public transportation and energy conservation can reduce global warming. Although 87% of students failed to see the links between meat consumption, the use of artificial fertilizers and climate change. The course aimed to empower students to seek solutions not only to climate change, but also to its causes.

During the course, the students have realized that climate policy needs to recognize the community's rights to deliver governance for climate change. During the course discussions, students encountered many unanswered questions that were raised in the lessons leading to research on topics of direct relevance to their lives. By addressing different topics students developed a comprehensive understanding of societal and environmental issues.

The course built students' **knowledge** on sustainability issues, including the climate change issue. The students developed a basic understanding of scientific concepts, developing the ability to distinguish between risks and consequences of environmental degradation. They have analyzed different responses to climate change and their applicability to local actions for sustainable development.

Conclusions Gained During Focus Group Interviews

Students have built their understanding on interlinkages among all aspects of sustainability: social, political, economic and culture aspect. By working with different dilemmas, students engaged in in-depth solutions on a conflict between economic development and environmental protection. The focus of the course was on developing students' competencies and rethinking their ways of living and consuming by developing new attitudes and skills for environmental protection, and by changing consumption patterns.

The other aspect of the course highlighted by the students were new competencies developed during the coursework, such as critical thinking, problem solving, managing uncertainty saying that these are critical for living in the sustainable community. As it was asserted by many scientists and stressed in numerous international documents: the ability to see the interconnectedness between different dimensions of sustainability and the complexity of systems can contribute to problem solving of sustainability issues (Dalors 1996; Sterling 2004, 2012; Sharp 2002; Filho et al. 2010). Such competencies as interdisciplinary and systemic thinking have also been emphasized by the expert review commission of UNESCO in 2011. This result appeared as well at the ESD World Conference on Education for Sustainable Development (2014) in Nagoya (Japan), putting the emphases on

the educational process which needs to be aligned with the engagement between the whole system, innovative pedagogies and participatory learning.

Several course participants pointed to the competencies they have developed during the course: "During the course I was encouraged to see the interdependency of issues and how to analyze each issue from the system's perspective," "by working together with the other participants from the other fields, their knowledge from the other fields enriched the discussion about the climate change issue."

Engagement of the course participants with the real life learning situations involved all aspects of learning: cognitive, affective, and practical domains, allowing the students to see themselves as agents of change in their local environments. This developed students' competency in dealing with uncertainty, together with a competency of participatory engagement with the real life issues, opened mindedness, cooperation, and reflection. These competencies are particularly essential in developing sustainability literacy (Stibbe 2009). As one of the course participants wrote: "The course broadened my view on global challenges, including disaster risk education challenges, climate change, issues affecting seas and oceans."

Both, focus group interviews and the analyses of students' essays indicate that the course raised environmental consciousness of students but did not fully modify their habits and behaviors towards sustainable consumption and lifestyles, desired by the course mentors.

Post-course survey allowed a realization that the students can explain tensions in sustainable development much better, although they focused more on the environmental dimension.

Attitudes. In the framework of the course the climate change issue was discussed in relation to values, equity and social justice.

One of the aspects disclosed in the group discussions and post-course essays was **a behavioral change**. The use of innovative pedagogies in a blended course fostered competence—ability to cope actively with the complex situations, acting upon and making decisions.

The transition towards sustainability requires action that is guided by understanding the various complexities of the processes and the ability to collaborate with people from diverse backgrounds. There are numerous studies that explore why people act the way they do because of the complexity of multifaceted human behavior in diverse contexts. Some argue that procedural knowledge is more effective in promoting behavioral change.

Several authors believe that knowledge and skills can lead to behavioral change. Many scientists argue that interest about climate change does not necessarily lead to action. Still, feelings of personal responsibility for climate change, the perception of influence of one's actions for a common good may lead to a change of behavior (Heimlich and Ardoin 2008). In essays the students pointed to small behavioral changes that they noticed in their everyday routine:

> "After completing this course I realized that I pay closer attention to some of my actions, like the amount of water and electricity I use. I become conscious of some aspects which I

neglected before." "The course encouraged me to rethink my way of living, consuming and purchasing, as well as the consequences of my choices."

The other revealing moment during the group discussions was a discovery of how students' actions can be linked to global actions and benefits. An example mentioned by the students was their involvement in Environmental Week. One of the limitations of this course was that one cannot expect changes in behavior overnight but they can take place only in the long run.

The reform processes in education in Latvia put the main focus on developing ESD competencies. This was also taken into account while evaluating students' achievement during this course. Students' performance during the course was evaluated according to acquired competencies, comprising knowledge, skills, values, and attitudes (Table 2).

Table 2 The analyses of students' responses in their essays (n = 39)

Category	Subcategory	Units	Examples of students' quotations
Knowledge (cognitive aspect)	Knowledge about a climate change	29	"During taking e-modules of the course I learned more about the risks and consequences of environmental degradation and different responses to climate change, as well as their applicability to local contexts concerning my life"
	Connectedness of personal world view and cultural assumptions and worldview of others	18	"When I evaluate how my grandparents live I see sustainability in every aspect of their life, when I observe the life of my parents, their choices are determined by economic needs and aspects of life which is quire sustainable, when I analyze my generations' lifestyle, it can be described as more consumerist"
	Integrative thinking about interrelatedness of social, economic, culture and political dimensions of sustainability	19	"While discussing with others I realized how interconnected is the surrounding world" "While exploring environmental issues with my classmates, we traced economic, political and cultural impacts on the problem of study"
	Relation of one's own thinking and action to sustainable development	25	"The more we discuss those issues during our classes, the more we understand that something needs to be done for the wellbeing of the Earth, and the actions of every single individual mean a lot"

(continued)

Table 2 (continued)

Category	Subcategory	Units	Examples of students' quotations
	Understanding of a need for change from unsustainable practices towards equity, solidarity, and environmental sustainability	31	"I understand the need to make at least small changes in my lifestyle. If each of us does at least a few things, the world would become a better place to live"
Skills	Ability for action	9	"I started to pay attention to how I can reduce the causes of climate change by doing small things, like consuming less, using less of public transportation, recycling"
	Work with different perspectives on dilemmas, issues, tensions and conflicts	15	"While doing my case study with my classmates I found quite controversial interpretations of the issue, and tensions in defining the issue"
	Evaluation of potential consequences of different decisions and actions	23	"While drawing future scenarios about the potential dangers of environmental problems I realized the potential danger of doing nothing to introduce some sustainable changes."
	Engagement in real-world by making a difference in practice	36	"I hear lots of alarming information about the ecological crises, but exploration of real cases makes environmental problems of personal importance"
	Recognition of impact of a human action on climate change	29	"I realized how much I abuse resources that has an impact of the planet" "Me and my classmates' consumeristic lifestyle carries its negative impact on climate change"
	Acting upon ways to reduce climate change	18	"I try my best to introduce small changes in my lifestyle, like walking more, buying less and using electricity less"

(continued)

Table 2 (continued)

Category	Subcategory	Units	Examples of students' quotations
Values	Awareness of climate change gravity	27	"I am becoming more aware of how my actions influence the wellbeing of all and the health of the Earth"
	Responsibility	12	"I realized, if each person takes a small action to preserve the Earth"
	Commitment for active participation to reduce the risks of climate change	7	"After completing this course I am more responsible in use of water and energy as well as of my consumption patterns"
Emotions	Sense of connectedness/ belonging to the environment	8	"I get inspiration from nature" "I restore my energies in the forest" "It is in nature where I feel restored and refreshed"
Actions (behavioral aspect)	Ability to change one's lifestyle	9	"I cannot transform my life style radically as it was in the film "No impart man" but I am ready to make small changes in my lifestyle"
	Achieving transformations: Willingness to challenge assumptions underlying unsustainable practice	21	"I am willing to reexamine my lifestyle and unsustainable practice by making some small changes"
	Envisioning change: making a positive contribution to other people and their social and natural environment, locally and globally	27	"I have realized how my small action can contribute to global changes and as a youth leader I am willing to make changes not only in my life but to organize the others to be more enthusiastic introducing positive changes"
	Envisioning change: taking considered action even in situations of uncertainty	18	"The more I studied about the sustainability issues, the more I see that there is a controversy in offered solutions and consequences of this question"

To conclude, prior to this study, students' knowledge was mostly centered around the environmental dimension of sustainability. During the course the students developed broader understanding of the sustainability issues by linking institutional and social aspects and become aware of controversies and tension, and potential effects of dealing with the climate change issue. While dealing with other issues, environmental issues could be seen as a starting point for exploring other dimensions of ESD, gradually developing into systemic and critical thinking actions (Reickmann 2012). Students are engaged now with the issue of study of more personal significance for the student specially when related to real world cases.

This case study was an attempt to implement SD and the study of ESD related issues such as climate change in one of the university's educational courses organized in blended modules and focused on the development of students' ESD competencies. This is a small attempt of integrating ESD. The findings of a post-course survey show that those who demonstrated holistic, long term thinking and broader understanding of ESD, are a minority. For integration of sustainability to become a holistic effort, the university needs to integrate SD in all its core activities. Still, universities should be seen as an ideal ground for developing research and innovations as a basis for discussion of the need of SD in universities.

A small scale of a case study restricts making generalizations but allows to trace the positive aspects of awareness of interconnectivity of environmental issues to social, economic and political aspects of sustainability, attitudinal changes and commitments of students to relate climate change issues to their everyday life, consumption habits. The course contributed to the development of students' transversal competencies, such as undertaking individual and collective responsibility, working with different and controversial perspective and thinking across disciplines.

Conclusions

There is undeniable evidence that climate change is a danger which compromises the sustainability of our planet. The importance of climate change to a large extent was neglected in school and the university's curriculum. Therefore, the study presents a challenge to integrate the issue about climate change by the use of innovative approaches in the university setting.

Education plays a crucial role in informing and empowering students to discover the possibility of their contribution in solving environmental issues by adopting a sustainable lifestyle and finding innovative solutions. Education can enable individuals to make informed decisions and to take actions for a climate-compatible sustainable development. What is missing, is a holistic vision of how sustainable society can be translated to the local level.

The course was intended to equip students with relevant life skills such as critical thinking skills, climate change literacy, problem solving skills, sustainable consumption and evaluation of one's lifestyles. The mentor of the course provided a

safe learning environment for discussion and for sharing ideas by offering blended learning strategies and multiple learning formats.

Education for sustainable development provided a framework for climate change education, thus encouraging students to be more informed about everyday life decisions accompanied by the responsible action. The course was intended to develop students' knowledge in conjunction with the evolution of their awareness and changes in personal behavior. The limitation of this course was that while the course outlined the scope of issues, there was not much time to explore issues in greater depth.

Climate change in the university study course was studied in relation to smart governance, policy debates, and in relation to societal issues, thus examining the implications of climate change in local contexts. The students developed an understanding about the impact of climate change on a local and future society. The analysis of students' essays indicates that they developed an understanding about the contexts as well as a developed flexibility to deal with uncertainty concerning climate change.

The students have learned that a climate policy needs to recognize community's rights to governance for climate change and the interconnectedness between climate change, economic matters, and social justice discourse. The course reached its broader aim to empower students to seek solutions not only to climate change, but also to its causes. This has led towards changes of attitudes, and to responsible action.

To be efficiently taught, the climate change issue needs to be taught in an accessible way and through multiple formats, such as e-learning, photos, films, video fragments, exercises and interactive games. Climate change issues need to be studied in relation to smart governance, policy debates, and societal issues, in order to examine the implications of climate change in local contexts.

For the climate change issue to be relevant for the students, it has to relate global and abstract issues to how one impacts on climate change and to how to equip students with skills, knowledge and values to deal with future challenges. Education should empower the students to see environmental, political, social and economic aspects of climate change in a more holistic way.

Considering the serious impact of climate change on our lives, educators need to frame climate change studies in a way that can be better acted upon by youth using diverse experiences, life circumstances, worldviews and values (Maibach et al. 2011).

As a major limitation and constraint of this case study is that it cannot be generalized to other contexts since it reflects the efforts of educators at one of the regional universities aimed raise students conscience about the causes, consequences and possible solutions of environmental issues, particularly, the issue of a climate change within a wider system framework of sustainable development. The gravity of consequences of environmental issue are worldwide still the problematics varies from the context to context. Pedagogical solutions and tools used to tackle these issues also vary from one institution to the other. The experience and the involvement of institutions in dealing with those issue are also diverse even within

the institutions of one country. This case study is a tentative innovative attempt to use innovative approached, including a blended course design, and other tools to touch the student a s holistic being: cognitive, emotional, value, behavioral aspects developing one's personal responsibility and commitment to work for a well-being of the planet.

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