Enriching understanding and promoting responsible behaviour to combat climate change: A case study involving the use of Kolb's experiential learning model

Evangelos Manolas

Department of Forestry and Management of the Environment and Natural Resources, Democritus University of Thrace, 193 Pantazidou Street, 68200 Orestiada, Greece

<u>emanolas@fmenr.duth.gr</u>

Michael Littledyke School of Education, University of New England Armidale NSW 2351, Australia <u>mlittled@une.edu.au</u>

Abstract. *Climate change is possibly one of the* central challenge humankind has ever faced. *Education is very important in dealing with such* a serious global issue. Yet, if education is to deal effectively with such challenges it will have to be education of a particular kind, one that engages people actively in the learning process, which leads to the possibility for behavioural change towards appropriate action for sustainability. After a presentation of the basic characteristics of Kolb's experiential learning model this paper used Kolb's model to design an innovative assignment for undergraduate or graduate students in institutions of higher education. The central aims of this assignment are to increase our understanding of individual inaction with regard to climate change and help people change their daily habits that cause the production of greenhouse gases. However, beyond the issue of climate change, the proposal put forward in this paper may prove useful in other areas of education for sustainability.

Keywords. Climate change, Experiential learning, Higher education.

1. Introduction

Climate change currently is and will continue to be a matter of great international concern. Global temperature has increased approximately by 0.7°C since the mid-1800s. The last decade is the warmest ever recorded. According to recent IPCC reports, most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations, which are mainly produced from the burning of fossil fuels and from deforestation [31]. If current trends in GHG emissions growth are not altered, global temperatures are expected to rise between 1.4 and 5.8° C (2.5 to 10.4° F) by 2100 [7].

Ackerman and Stanton [1] summarize the likely impacts of climate change by an incremental increase in average global temperature. It should be emphasized that all predictions of emissions scenarios and likely temperature changes are estimates, not exact figures. Some of these impacts include:

0.6°

More frequent extreme weather more floods and more events. droughts, more heat waves. A slow pole-ward migration of plant and animal species, with less mobile and less adaptable species increasingly at risk of extinction. 2° More tropical diseases over a wider geographical area. yields Decreased crop the in developing world and, as a result, widespread hunger. Many communities facing serious water stress and widespread droughts. 30 Decreasing crop yields in the developed world and decreasing world food supplies.

Evangelos Manolas, Michael Littledyke (2010). Enriching understanding and promoting responsible behaviour to combat climate change: A case study involving the use of Kolb's experiential learning model, M. Kalogiannakis, D. Stavrou & P. Michaelidis (Eds.) *Proceedings of the* 7th *International Conference on Hands-on Science*. 25-31 July 2010, Rethymno-Crete, pp. 131 – 137 http://www.clab.edc.uoc.gr/HSci2010 Widespread species extinctions and desertification. 4°

Entire regions will have no agricultural production whatsoever and the melting of the West Antarctic ice sheet will gradually increase sea levels by 5 to 6 m. $>4^{\circ}$

There is a 50-50 chance that the ocean's circulation system will shut down, removing the crucial currents that warm and stabilize the climate of Northern Europe.

Using results from surveys in Europe and Germany, Kuckartz [14] points out that we still have a long way to go in order to have truly empowered persons with regard to climate change. Although 80 to 90% of those surveyed are sensitive about climate change, only 20 to 50% are knowledgeable about climate change and a much smaller percentage, 5 to 20%, actually takes action to combat the problem. These statistics show that, while the vast majority of people are concerned about climate change, they are less inclined to take personal actions or to support policies that can counter such change. They also show that, although there is widespread concern, this concern is of secondary importance in guaranteeing that people will adopt the required behaviours for change. Is individual behaviour important for combating climate change? Available evidence shows that it is. If individual behaviour contributes 30 to 40 percent to greenhouse gas emissions [15], [29], then changes in individual life styles, such as modifying transport use, energy use, patterns of settlement, the design of homes, consumption of food and other goods and / or accepting higher prices for some products and services, will not be negligible at all.

Education is very important in dealing with such a serious global issue such as climate change, and this is prioritised by UNESCO (United Nations Educational, Scientific and Cultural Organisation) in the United Nations Decade of Education for Sustainable Development (2005-2014), which seeks to integrate the principles, values, and practices of sustainable development into all aspects of education and learning, in order to address the social, economic, cultural and environmental problems we face in the 21st century [30].

in environmental Action competence education proposes linking knowledge of the environment and positive attitudes to promote behavioural change through appropriate action to support the environment [8], [2], [9]. Action competence has wider implications for education active for sustainability, and requires engagement of the learner in the learning process. Kolb defined experiential learning as a "holistic integrative perspective on learning that combines experience, perception, cognition and behaviour" [12]. Kolb's experiential learning model [12] is commonly regarded as one of the best ways for engaging students in active learning approaches. Kolb's experiential learning model is used and recommended for use in a variety of disciplines [20], [3], [6], [4], [26], [28], [10], [17], [18]. However, there are teachers who are not aware of [6] or do not use or ignore this method of work [4], [26]. The aim of this paper is to apply Kolb's model in designing an innovative assignment in dealing with climate change, one which could be applied to both undergraduate and graduate courses. The central aims of this assignment are to increase our understanding of individual inaction with regard to climate change and help people change their daily habits that cause the production of greenhouse gases.

2. Kolb's Experiential Learning Model

Building upon earlier work by John Dewey and Kurt Levin, American educational theorist David A. Kolb [12] created a theory which consists of four learning stages: concrete experience, reflective observation, abstract conceptualisation and active experimentation.

The first stage, concrete experience, is where the learner actively experiences an activity such as a laboratory session or field work. Learning in this stage is based more on open-mindedness and adaptability as a precursor to systematic engagement with the situation or problem. The second stage, reflective observation, aims to understand the experience. In this stage, students approach their concrete experiences from a variety of viewpoints and articulate why and how The third stage, abstract they occurred. conceptualization links observations and reflections into a theory or concept. In this stage, the aim is to understand the general concept of which the concrete experience was one example. The fourth stage, active experimentation tests the theories and leads into new experiences. In this stage, students use the theories they learned or developed in the abstract conceptualization stage in order to attempt predictions about the real world and then act on those predictions. Students' actions are a new concrete experience. The learning cycle begins anew.

The key to planning lessons that take students full cycle is to note that the second word in each of the four stages' names indicates what the learner experiences. The learner begins by having an experience that involves him or her in a situation (experience) and then reflects on the several perspectives experience from (observation). From those reflections, the learner draws concepts or conclusions and formulates them into theories or models (conceptualization) them to experiment or that lead act (experimentation).

Kolb found that learners typically did not use all four learning stages equally, but preferred to focus on one or two of them. He identified four learning preferences, each of which shows learners being most comfortable in a different pair of learning stages. Based on responses to a set of questions called the Learning Style Inventory, Kolb described the four learner preference groups as divergers, assimilators, convergers, and accommodators. Understanding the preferences is fundamental for understanding how students may respond to lessons designed specifically for each stage.

Divergers prefer learning through concrete experience and reflective observation. They may be very good at viewing a situation or problem from many perspectives and developing imaginative solutions. Assimilators prefer conceptualization abstract and reflective observation. These individuals can often pull together very different observations into an explanation or theoretical model. Convergers learn best through abstract conceptualization and active experimentation. Their strength lies in the practical application of ideas. They tend to organize their thinking to use hypotheticaldeductive reasoning to focus on specific problems. The dominant learning preferences of accommodators are concrete experience and active experimentation. Accommodators tend to be risk takers who thrive on action and new experiences.

Teaching techniques that provide opportunities for concrete experiences include observations, experiments, simulations, fieldwork, storytelling, films, jokes, cartoons, newspaper articles, examples, taking a survey, role play or reading texts. Techniques that provide opportunities for reflective observation include journals, logs, discussion, brainstorming, thought questions and rhetorical questions. Listening to lectures, seeking out and critiquing in texts or articles. generating models hypotheses, concept maps, building models and construction analogies, papers and projects draw upon abstract conceptualization. Doing case studies. simulations, fieldwork, projects, homework, conducting an experiment in the laboratory or in the field require students to engage in active experimentation [12], [3], [6], [10].

In addition to the points raised above, it must always be kept in mind that learning increases by up to 50 percent if educators set clear and meaningful goals [13].

The assignment which follows is an adaptation of an assignment designed by Sprau [26] while the idea to use the adoption of an environmental behaviour as а concrete experience is inspired by a recent research effort involving teachers and students in voluntarily trying environmental behaviours [24]. The aim is to produce a learning activity that can be easily and widely applied in undergraduate or graduate courses and which can hopefully increase our understanding with regard to combating the problem of individual inaction against climate change and possibly promote environmentally responsible behaviours.

3. An application: An innovative assignment

Objectives

- To create interest in the issue of climate change
- To promote understanding of the problems of actions that contribute to climate change
- To encourage reflection, thought and individual action against climate change The Assignment

What follows is a description of a semester project, which can be used in environmental education courses for undergraduate or graduate students. The experimentation with environmental behaviours and the writing of the assignment is intended to acquaint students with Kolb's experiential learning model, serve as an alternative to the traditional research / term paper and encourage students to adopt and think about responsible environmental behaviours in their personal lives.

1. Choosing an environmental behaviour

Every student is invited to experiment with environmental behaviour in their own lives, such as, for example, reducing their consumption of electricity, water, paper towels, and overpackaged products, walking more frequently etc. Students may be given a list of responsible environmental behaviours to choose from.

2. Experimenting with the chosen environmental behaviour

Students experiment with the environmental behaviour they chose for a month. Since the duration of a semester is about four months then one month seems like an appropriate time span for the experimenting with the particular behaviour, as this leaves adequate time for creating an outline, as well as writing and submitting the paper. The experimentation with the chosen environmental behaviour is a concrete experience. Following the completion of the onemonth experimentation period, students should meet with their tutor so that they can receive guidance with regard to producing an outline of their paper. The tutor encourages students to identify difficulties they encountered while trying the behaviour, factors which helped them persevere in the undertaken change as well as feelings they experienced during their effort. This takes students into Kolb's second stage, reflective observation.

3. The paper outline

Following the meeting with their instructor the students create a detailed outline describing what they plan to do in the final paper they will submit. The paper outline moves students from reflective observation into the abstract conceptualization stage. The outline also helps students organize their thoughts about the structure and contents of their papers early in the thinking process.

4. Research

Initially, students investigate the implications of the selected actions on climate change through reduced greenhouse gas emissions, e.g. reduced burning of fossil fuels through less car use, reduced energy consumption in the home through switching off lights, avoiding use of standby settings etc. or reduced consumption of materials and associated energy use through recycling or reduction in purchasing patterns. The research requirement offers further opportunity for more sophisticated abstract conceptualization. Students are directed to relevant academic literature for use in their paper.

The sources that students should be directed to use in their papers should not be too many or too long (given the amount of time left until submission of papers), should give practical advice to the reader and should raise or inspire important new questions that would need to be answered for adoption of sustainable behaviours, but also for purposes of enriching our understanding of the issue on an academic basis. The work of Kollmus and Agyeman [11], Pruneau *et al.* [24], Moser [21], Lorenzoni, Nicholson-Cole and Whitmarsh [16], Moser [22], Spence and Pidgeon [25] and Swim *et al.* [27] meet the criteria set above.

5. The Writing Process

After completing the outline and following tutor support, students submit a rough draft. Requiring students to organize and develop their ideas in a rough draft encourages further, and more the complex, thinking in abstract conceptualisation stage. Rough drafts are submitted and returned to students at least two weeks before the final draft deadline. Although tutor comments on student drafts will vary from daft to draft, nevertheless, some key questions to be addressed by the tutor may be: Why did you choose to try the environmental behavioural you chose? How may the behaviour influence climate change by reduction of greenhouse gas emissions? Which barrier(s) were the most important? How are the barriers linked to environmental, social or economic issues that may affect you? To what extent did the barriers occur in sequence? What sequence? Which approaches were most effective in overcoming each barrier? On the basis of your experience can you identify new examples to add to the ones used in existing definitions of barriers? On the basis of your experience did you discover any new barriers to add to the lists provided by the academic literature made available to you? On the basis of your experience can you think of new factors aiding or inhibiting the adoption of the environmental behaviour you tried? Will you keep the environmental behaviour you adopted in the future?

The writing process also constitutes Kolb's last experiential learning stage, active experimentation. The issue of how to deal with climate change is context specific, which means that there will be variations from individual to individual and from society to society. And if this the case then the engagement of people in such a project is essential for making progress on addressing the issue of climate change, both with regard to increasing individual action and with regard to filling gaps in the existing literature.

4. Some observations

Of particular importance seems to be the effect of such activities on the view people have about themselves. Although it is not certain whether people will adopt responsible environmental behaviours for life after they have completed such a project [24], nevertheless, such an activity gives people opportunities to experience certain conditions that may have a beneficial effect on them as individuals contributing to globally implicated problems of climate change. Hariz [5] refers to 5 such conditions most of which are relevant to the activity developed in this paper:

(1) Self – the individual's need for a positive feeling about him/her self as a person.

(2) Personal meaning – the individual's ability to reach an understanding of him / herself and his / her learning.

(3) Action – the ability of the individual to develop, apply, and measure the use of his own, and other people's ideas in the learning place; and to learn from the experience.

(4) Collegiality – the individual's capacity to learn with and from colleagues in both a direct and indirect way.

(5) Empowerment – the ability of the individual to "feel a sense of ownership, autonomy, self-control and self-direction over their decisions and actions, including over the processes and outcomes of their learning".

The activity discussed in this paper provides opportunities for people to identify and overcome barriers to combat an important environmental problem, while simultaneously turning a class assignment into a life experience. At the same time, everyone gets personally involved, everyone gets the opportunity to critically and constructively review their effort, confirm and expand facilitating and limiting factors and identify areas of personal improvement, e.g. by using better existing competencies or developing new ones.

At the same time it engages students with important academic literature and gives them a chance not only to understand but also to evaluate and enrich these sources. The list of barriers to engagement, as well as the list of facilitating and limiting factors to individual action against climate change is certainly not complete. For purposes of enriching the existing literature the discovery, for instance, of new barriers to engagement or of new examples of a barrier, is something which enriches the particular concepts for the specific phenomenon because it reflects the essence of a larger quantity of instances of the phenomenon [19]. Some have even suggested that such individual experiences may prove more revealing and innovative than the ones we already know [23] and, can, consequently, be invaluable in advancing our knowledge in the specific fields they belong to.

5. Conclusion

Climate change is possibly one of the central challenges humankind has ever faced. Education is very important in dealing with such a serious global issue. Yet, if education is to deal effectively with such challenges it will have to be education of a particular kind, one that engages people actively in the learning process, which leads to the possibility for behavioural change towards appropriate action for sustainability. After a presentation of the basic characteristics of Kolb's experiential learning model this paper used Kolb's model to design an innovative assignment for undergraduate or even graduate students in institutions of higher education. The central aims of this assignment were to increase our understanding of individual inaction with regard to climate change and help people change their daily habits that cause the production of greenhouse gases. However, beyond the issue of climate change, the proposal put forward in this paper may prove useful in other areas of education for sustainability.

5. References

- Ackerman F, Stanton E. Climate Change The Costs of Inaction; 2006. Accessed 8 July 2009. Available: <u>http://www.foe.co.uk/re</u> <u>source/reports/econ_costs_cc.pdf</u>
- 2. Breiting S, Mogensen F. Action Competence and Environmental Education. Cambridge Journal of Education 1999; 29(3): 349-353.
- Brock KL. Enlivening Political Science Courses with Kolb's Learning Preference Model. Political Science and Politics 1999. Accessed 10 February 2002. Avaiable: <u>http://www.findarticles.</u> <u>com/cf 0/m2139/2 32/54895453/print.jhtml</u>
- 4. Frederick PJ. Student Involvement: Active Learning in Large Classes. In: Bridges GS, Desmond S, eds. Teaching and Learning in Large Classes; Washington: American Sociological Association; 2000. p. 143-150.
- Hariz A. Experiential Learning: An Important Strategy towards a Productive Work Environment; 2008. Accessed 10 May 2010. Available: http://icee2008hungary. net/download/fullp/full_papers /full paper195.pdf
- Healey M, Jenkins A. Learning Cycles and Learning Styles: Kolb's Experiential Learning Theory and its Application in Geography in Higher Education; 2000. Accessed 10 February 2002. Available: <u>http://</u> www.chelt.ac.uk/el/philg/gdn/discuss/kolb1.

www.chelt.ac.uk/el/philg/gdn/discuss/kolb1. htm

- 7. Human Development Report 2007/08, UNDP. Accessed 11 July 2009.Available:<u>http://hdr.undp.org/en/media/ HDR_20072008_EN_Complete.pdf</u>
- 8. Jensen BB, Schnack K. The Action Competence Approach in Environmental Education. Environmental Education Research 1997; 3(2): 163-178.
- 9. Jensen BB. Knowledge, Action and Proenvironmental Behaviour. Environmental Education Research 2002; 8(3): 325-334.
- Kelly C. David Kolb, The Theory of Experiential Learning and ESL; 2002. Accessed 11 February 2002.Available: <u>http://www.aitech.</u> <u>ac.jp/~iteslj/Articles/Kelly-Experiential/</u>

- 11. Kollmuss A, Agyeman J. Mind the Gap: why do people act environmentally and what are the barriers to pro-environmental behaviours? Environmental Education Research 2002; 8(3): 239-260.
- 12. Kolb DA. Experiential Learning: Experience as the Source of Learning and Development. Englewood Cliffs: Prentice-Hall; 1984.
- Kolb DA. Personal Learning Guide: Selfstudy Booklet. A Personal Guide for Setting Learning Goals and Learning Strategies. Boston: McBer and Company; 1985.
- Kuckartz, U. Cherries from Timbuktu. Why despite better knowledge, behaviour patterns do not change. Presentation to The Great Transformation. Climate Change as Cultural Change International Conference; 2009 Jun 8-10; Essen, Germany; 2009. Accessed 8 July 2009. Available: <u>http://www.greattransformation.eu/images/st</u> <u>ories/downloads/kuckartz_presentation_opt.p</u> <u>df</u>
- 15. Lawrence C. Behavioural Barriers to Effective Climate Change Policy; 2008. Accessed 12 May 2010. Available: http://www.ope rationclimatechange.com.au/docs/climatecha nge/Behavioural%20Barriers%20to%20Effe ctive%20Climate%20Change%20Policy.pdf
- 16. Lorenzoni I, Nicholson-Cole S, Whitmarsh L. Barriers perceived to engaging with climate change among the UK public and their policy implications, Global Environmental Change 2007; 17: 445-459.
- 17. Manolas E. Kolb's Experiential Learning Model: An Application in the Sociology of the Natural Environment. Nea Paedia 2003; Issue 106: 33-39.
- Manolas E, Kehagias T. Kolb's Experiential Learning Model: Enlivening Physics Courses in Primary Education. Proceedings of the 2nd International Conference, Hands-on Science: Science in a Changing Education; 2005 Jul 13-16; Rethymno: University of Crete; 2005. p. 286-289.
- 19. Manoledakis I. *Introduction to Science.* 3rd *Edition.* Thessaloniki: Paratiritis; 1994.
- Mansfield DL, Murrell P. The Use of Student Learning Styles in Teaching World Politics. Innovative Higher Education 1991; 5(2): 127-136.
- 21. Moser SC. Talk of the city: engaging urbanites on climate change. Environmental Research Letters; 2006. Accessed 26 April 2010.Available:<u>http://iopscience.iop.org/174</u>

<u>8-9326/1/1/014006/pdf/1</u>748-9326 1 1 014006.pdf

22. Moser SC. (Lead Author); The Canada Institute of the Woodrow Wilson International Center for Scholars (Content Walser, ML. (Topic Editor); Partner): Communicating climate change motivating citizen action. In: Encyclopaedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition. National Council for Science and the Environment); 2008. Accessed 6 March 2010.

Available:<u>http://www.eoearth.org/article/Co</u> <u>mmunicating_climate_change_motivating_ci</u> <u>tizen_action</u>

- Page CH. Sociology as a Teaching Enterprise. In: R. K. Merton, L. Broom and L. S. Cotrell, Jr. (Eds). Sociology Today: Problems and Prospects. New York: Basic Books 1959; p. 579-599.
- 24. Pruneau D, Doyon A, Langis J, Martin L. et Ouellet E, Boudreau G. The process of change as experimented by teachers and students when voluntarily trying environmental behaviours. Applied Environmental Education and Communication 2006; 5(1): 33-40.
- 25. Spence A, Pidgeon N. Psychology, Climate Change and Sustainable Behaviour. Environment Magazine 2009; Accessed 30 April 2010. Available:<u>http://www.environmentmagazine.</u> org/Archives/Back%20Issues/November-December%20200 9/Psych-Climate-full.html
- 26. Sprau R. I Saw it in the Movies: Suggestions for Incorporating Film and Experiential Learning in the College History Survey Course. College Student Journal 2001. Accessed 25 October 2004. Available:<u>http://www.findarticles.com/cf_0/ m 0FCR/1_35/74221513/print.jhtml</u>
- 27. Swim J, Clayton S, Doherty T, Gifford R., Howard G., Reser J, Stern P, Weber E.

Psychology and global climate change: Addressing a multi-faceted phenomenon and set of challenges. A report by the American Psychological Association's task force on the interface between psychology and global climate change; 2009. p. 123-136. Accessed 15 April 2010. Available:<u>http://www.psychologymatters.org</u> /science/about/publications /climatehange.pdf

- 28. Terry M. Translating Learning Style Theory into University Teaching Practices: An Article Based on Kolb's Experiential Learning Model. Journal of College Reading and Learning 2001; 32(1): 68-85.
- 29. U.K. Energy Research Centre (UKERC). Making the Transition to a Secure and Lowcarbon Energy System: Synthesis Report; 2009. Accessed 6 May 2010. Available:<u>http://www.ukerc.ac.uk/Downloads/</u> PDF/09/0904Energy2050report.pdf
- 30. UNESCO Education for Sustainable Development; 2010. Accessed 17 May 2010. Available: http://www.unesco.org/en/esd/
- 31. Yencken D, Henry N. Common Misconceptions about Climate Change; 2008. Accessed 15 December 2008. Available: <u>http://www.australiancollaboration.com.au/</u>

factsheets/1.%20Misconcept_Climate_FactS heet.pdf