

Chapter 41

Path to the Future for Climate Change Education: University Project Approach

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Abstract The university system can be conceived as an institution that nurtures, trains, educates, and monitors students in the understanding of myriad bodies of knowledge about the Earth system and all other natural and human activities. With particular reference to climate change education, it also engages students in research activities as a way of learning science, understanding climate change, contributing to climate change studies and participating in several local and international workshops, seminars, and conferences. This paper focuses on how climate change projects within the university system can be used to develop and build capacities in the field of climate science. The study develops a triadic model of capacity building built around training, mentoring, and networking. A case of Assessments of Impacts and Adaptations to Climate Change (AIACC) project in sub-Saharan West Africa is used to illustrate this model. Considering the fact that many developed and developing countries are vulnerable to the impacts of climate change, albeit with different intensities, it is recommended that these countries adopt this triadic model so as to increase capacity, as well as reduce their levels of vulnerabilities to climate change impacts.

Keywords Adaptation · AIACC · Climate change · Nigeria · Obafemi Awolowo University · Vulnerability

Introduction

Climate change is an issue of global importance and it is fast becoming a subject that permeates every aspect of human lives. Increases in CO₂ emissions and global economic meltdown in both the developed and developing countries are creating serious problems, as energy use and CO₂ emissions continue to increase in countries

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such as the United States (US), China, and India through their heavy reliance on coal and energy needs (Sheehan 2008). The information from the US Department of Energy's Energy Information Agency for the USA puts the projection of energy use and CO₂ emission from fuel combustion at 1.1% and 1.2% per annum from 2005–2030 respectively, with energy use and emissions from coal use both growing at 1.6% per annum (DOE 2007). A similar trend is noticed in key developing countries such as China and India where coal constituted 71% and 55% of their total primary energy supply (excluding biomass and waste) in 2004 (IEA 2006). The big coal plants, which are currently being built in Germany, can only add to the present challenges of climate protection (Meinshausen and Hare 2008). However, research efforts over the years and new commitment by the Group of Eight (G8) may help improve our understanding of some of the complexities and technicalities involved in the science of climate change in the near future. The improvements made with respect to the strategies to adapt and mitigate climate change impacts on social, political, and economic developments would also be useful. As a result of these highly focused research activities and new initiatives, we have been able to reduce many uncertainties. Interdisciplinary research projects have also enabled us to identify the most cost-effective measures to mitigate climate change (European Commission 2005). For instance, research focusing on science, technology and innovation has improved the future for low-carbon society and initiated several climate-friendly technologies. Moreover, the approval of economic stimulus packages that incorporate environmentally friendly research activities in some developed countries could cause an increase in the number of green jobs created in these countries. Issues such as these have contributed to global arguments about climate change studies as one of the most important environmental challenges of the twenty-first century.

This paper examines how university projects can contribute to climate change education development by strengthening the capacity to comprehend the complex relationship between the Earth, atmosphere, ocean, and the cryosphere. The university system can be conceived as an institution that nurtures, trains, educates, and monitors students in their understanding of the Earth system and all other natural and human activities. Moreover, with particular reference to climate change education, it also engages students in research activities as a way of learning science, understanding climate change, contributing to climate change studies, and participating in several local and international workshops, seminars, and conferences. However, as important as study of climate change is, very few universities in the world have climate change as a distinct course of study at the undergraduate level.

It is now becoming increasingly clear that the primary factor responsible for the development and wealth of countries and individuals is intellectual capital (Pawowski 2004). The development of countries such as Hong Kong, Japan, and Singapore with little or no natural resources and the astronomical growth of giant corporations such as Google, Microsoft, Cisco, and Nokia give credence to this fact. The rallying point for these nations and corporations is scientific research and generations of new knowledge, which the university system readily provides. This study elucidates the role of universities within the wider context of learning. It looks at a range of programme activities that support university project goals, including

increasing students' participation in regional and international gatherings focused on the issues of climate change. Consistent with the aim of capacity development, the paper intends to explore new ways of strengthening students' capacity to contribute to climate change studies both at the local and international levels.

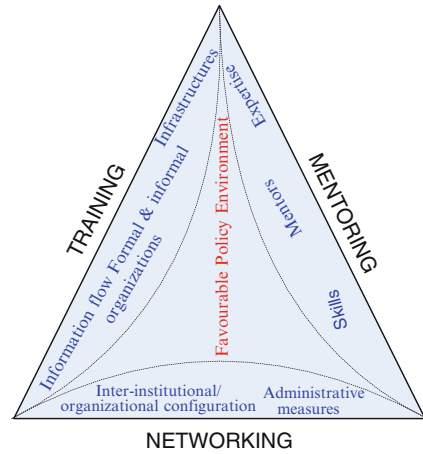
Central to most international conventions such as the United Nations Framework Convention on Climate Change is capacity building, especially among developing countries. Capacity transcends the availability of potentials in a particular area of expertise. It involves the ability of the individual, institution, or society to be able to solve a particular problem. Capacity can be regarded as the ability (of an individual, institution, or society as whole) to identify and solve a problem or problems, while capacity development has been described as the processes of creating, mobilizing, utilizing, enhancing or upgrading, and converting skills/expertise, institutions, and contexts for greater good (Mugabe et al. 2000).

This study emphasizes that it is important to teach students to carry out systematic assessment of evidence of climate change around their local environment, as well as within the global community. Students must also learn the process and steps of carrying out scientific research so as to generate evidence-based explanations and to understand human influences on the environment. It is within this context that we propose the use of university projects on climate change as an educational programme for university students at all levels (undergraduates and postgraduates). It is also important for the teacher to understand the basic interrelationship between Earth's systems. This will allow students to understand concepts about climate change, how they were arrived at, and the necessity to reduce the impacts. This paper examines the case of the Assessments of Impacts and Adaptations to Climate Change (AIACC) project in sub-Saharan West Africa to illustrate the model that can be used to achieve this goal.

Climate Change Education: The AIACC Project

AIACC was developed as a global initiative in collaboration with the United Nations Environment Programme (UNEP)/World Meteorological Organization (WMO), Intergovernmental Panel on Climate Change (IPCC), and funded by the Global Environment Facility (GEF) to advance scientific understanding of climate change vulnerabilities and adaptation options in developing countries. This initiative intends to achieve this by giving collaborative research grants, training, and technical support to developing countries. The focus of this initiative is to enhance the scientific capacity of developing countries to assess climate change vulnerabilities and adaptations, and generate and communicate information useful for adaptation planning and action. The implementation of the programme rests on the shoulders of UNEP and is executed jointly by System for Analysis, Research and Training (START) and the Third World Academy of Sciences (TWAS). There is also a synergy between the GEF, the United States Agency for International Development, the Canadian International Development Agency, the United States Environmental Protection Agency, and the World Bank in terms of collateral funding. AIACC

Fig. 41.1 A triadic model of capacity building



intends to fill the gaps that exist in understanding the nature of the vulnerability and opportunities for adaptation in developing countries. A further aim of the organization is to improve scientific and technical capacity to conduct multi-disciplinary regional research in the area of climate change. One of the most critical components of the AIACC capacity building programme is the expertise that scientists will gain through participation in multidisciplinary research teams. The major components of this capacity building are training, mentoring, and networking. The paper intends to situate the proposed approach for climate change education on these three cardinal components, which form a triadic model of capacity building (see Fig. 41.1).

Training

This component comprises the combination of formal and informal organizations, non-governmental organizations, information flow, financial incentives, and infrastructures. It is within the institution that the training of future experts will be done. In order for the training to have the desired impact, each of these elements must be properly structured. Under this component, seminars, workshops, and conferences should be organized to teach the students the basic concepts of climate change. The institutions should invite international experts from international organizations such as IPCC, GEF, UNEP, and other non-governmental organizations to provide training in the methods and tools for assessing vulnerability and adaptation and constructing scenarios of climate and associated socio-economic conditions. This training is best located in the third year for the undergraduate students and after the completion of courses for postgraduate students. The success of this training should be assessed by the level of understanding of students in the basic concepts of climate change and the quality of potential projects that students are able to propose, including the scientific design of their proposed projects. Group structures should also provide opportunities for participants to learn from each other. Another approach to training students could include active participation of the students in

the field, which could be achieved by introducing students to local farmers who are most vulnerable to the impact of climate change. Students should be encouraged to engage the farmers in discussions about issues related to climate change with the intention of building the adaptive capabilities and resilience of the local farmers. During these discussions, the local, conventional, and emerging technologies in terms of adaptation and mitigation techniques should be documented, while experimental farms may be set up where the documented techniques would be tested. However, it is important that the experimental farms are selected using parameters such as income of the farmers, social status, age, etc. It is important at this stage to also include other stakeholders (such as governments, agricultural input companies) in this process. The stakeholders are very important because they provide both knowledge and hardware supports for the farmers. For instance, government agencies such as the agricultural extension workers will update farmers' knowledge and keep them abreast of the latest information on farming systems. They also pass across farm inputs such as new seedlings. At the same time, agricultural input companies could provide farm inputs such as fertilizers and farm implements. They could also provide small grants for the farmer to acquire farms' implements.

Mentoring

Another approach in strengthening capacity building in climate change studies is mentoring. This section involves the expertise in climate change studies that could identify problems and provide solutions. The point of focus for this expertise is to stimulate interest of students in the study of climate change. This can be achieved by inviting or linking students with reputable scientists or policymakers who have an interest in the area of climate change. These mentors could also help the students plan and initiate their projects. The university should also make available a database of notable scientists in the field of climate change to the students, which they can choose from. The mentors should be drawn from both developing and developed countries and assist the students throughout the course of their projects. The mentors should guide students in the selection and application of data, sample size, methodology, models, and scenarios for climate change studies, as well as attending to any other problems that may arise while the students are working on their projects. Mentors should also teach the students about publishing, especially in peer-reviewed journals, and support students in publishing their projects in reputable journals. Mentors should be able to inform students of both local and international conferences and workshops where they can enhance their capacities.

Networking

Capacity development is time-dependent. Some societies may possess skills to solve a particular problem, while those skills may be inadequate to overcome emerging and future challenges. As a result of this, there is the need to create a conducive

policy environment where students may interact with the experts. This environment provides the condition to enable economic, political, sociocultural, general infrastructure, inter-institutional/organizational configuration, adequate policies, laws, and administrative measures (Mugabe et al. 2000). In order for students to have interactions with experts and other students from different locations with similar or diverse experiences, it is important to organize regional workshops in various locations such as Africa, Asia/Pacific and Latin America/Caribbean, United Kingdom, and USA. These regional workshops could also bring together the project mentors, researchers, and stakeholders from developing and developed countries to discuss current issues, techniques and methodology on climate change studies. Participants and students may present papers from their research activities, while mentors advise students and collaborate across study teams to solve common problems and plan for joint publications with the students. For sustainability of networking, there should be dedicated online discussion groups where further interaction can take place. The dedicated online discussion group would bring together and strengthened regional networks of scientists and students who can collaborate and develop effective teams in investigations of climate change.

A good example of this approach is that of the Asia-Pacific Network for Global Change Research (APN). The APN is an inter-governmental network for the promotion of global change research and linking science and policy making in the Asia-Pacific Region. Members of this network include Australia, Bangladesh, Cambodia, China, Fiji, India, Indonesia, Japan, Lao People's Democratic Republic, Malaysia, Mongolia, Nepal, New Zealand, Pakistan, Philippines, Republic of Korea, Russian Federation, Sri Lanka, Thailand, United States of America, and Vietnam. However, what is lacking within this network is dedicated online group discussion (where researchers can interact with students) and students' active participation. Another example of this model is the Climate Change Research Network at Vanderbilt. This network is very close to the model suggested in this study. It includes a team of faculty lecturers and graduate students who are conducting theoretical and applied research on climate change studies. The Climate Change Knowledge Network is another centre that brings together expertise, experience, and perspectives from research institutes in developing and developed countries that are active in the area of climate change. It also provides a forum for rigorous research on issues in climate change and provides a means for furthering dialogue between countries as they undertake efforts to address climate change. Again, active participation of both graduates and undergraduates is lacking.

Capacity-Building Operations of the AIACC

There are several initiatives that examine impacts and vulnerabilities of the Earth's response systems to climate change. One such initiative is the AIACC. This global initiative was developed in collaboration with the UNEP/WMO IPCC and funded by the GEF to advance scientific understanding of climate change vulnerabilities and

adaptation. It focuses mainly on developing countries. The initiative provides funding for collaborative research, training, and technical support. By so doing, it enhances the scientific capacity of developing countries to assess climate change vulnerabilities and adaptations, and generate and communicate information useful for adaptation planning and action (Adejuwon 2006). Its main contribution to the global body of knowledge is filling the gaps in scientific knowledge and capacity by funding, training, and mentoring researchers in developing countries to carry out multi-sector, multi-country research of their own designs (Leary and Kulkarni 2007).

The AIACC project is one of the focal climate change activities of the GEF. The GEF was the primary source of funding for the AIACC project with a grant of US \$7,500,000. Other grants came from the Canadian International Development Agency (US \$100,000), the Rockefeller Foundation (US \$25,000), the United States Agency for International Development (US \$300,000), the United States Environmental Protection Agency (US \$50,000), and the participating developing country institutions (valued at US \$1,800,000) (Leary and Kulkarni 2007).

The organization has provided financial support to 24 regional study teams, 46 developing countries, 235 developing country scientists, and more than 60 graduate and undergraduate students to conduct 3-year investigations of climate change impacts, adaptation, and vulnerability. More than 25 Master's and PhD theses that received support through participation in AIACC regional assessments were completed (Leary and Kulkarni 2007). The focus of the research activities in these countries are vulnerabilities to climate change, stresses, their implications for human development, and policy options for mitigating the adverse impacts. The array of information, knowledge, tools, and skills generated by these research activities has enhanced the ability of the scientists to assess many countries' vulnerabilities and adaptation options. This model of capacity building is close to the model suggested in this study. However, in terms of students' participation, students' share ratio and level of active participation is very low. Addressing this issue will make this model one of the most appropriate methods for capacity building for students with focus on climate change studies. This research-driven capacity building can be complemented by the other three components of capacity building: training, mentoring, and networking. The engagement of stakeholders in the vulnerability assessment process has further strengthened the information base for policymakers to make informed decisions about adaptation to climate change in these countries.

The success of these assessments projects has produced over 60 papers in peer-reviewed journals and books and over 40 papers in the online peer-reviewed *AIACC Working Papers* series. In terms of student participation, there were more than 25 student theses (Leary and Kulkarni 2007). Another indicator of success is the number of citations in the recent IPCC 4th Assessment Reports and contribution to the national communications to the United Nations Framework Convention on Climate Change (UNFCCC).

Due to the multi-disciplinary nature of the AIACC projects, many scientists have been able to create networks across disciplines, institutions and countries. These networks have resulted in collaboration that could yield further research investigations. Since most of the AIACC workshops engage stakeholders, their involvements

have resulted in important inter-country collaborations in the area of climate change studies, such as the ones we have among Kenya, Uganda and Tanzania; Mozambique, Malawi, and Zambia; Egypt and Tunisia; Thailand, Cambodia, Lao PDR, and Vietnam; and Argentina and Uruguay. These stakeholders from various sectors of the economy are being brought together to assess climate change vulnerabilities and cost effective adaptation options. It is therefore not surprising that AIACC was able to select top scientists in the developing countries in 2002 to participate in the IPCC's 4th Assessment Report through the established network of AIACC scientists. The nomination of these scientists in developing countries also broadened their horizons and enhanced their perceived level of professionalism among their counterparts across the globe. Both local and international activities have assisted most of the AIACC participants to be key actors in international activities that relate to climate change. Also, some of the participants have gained international grants from organizations such as GEF, the MacArthur Foundation, the Inter-American Institute for Global Change Research, the Asia-Pacific Network, and others (Leary and Kulkarni 2007).

Model of Climate Change Education: The AIACC Project at Obafemi Awolowo University, Nigeria

This section describes the capacity building activities of the AIACC project at the Obafemi Awolowo University, Ile-Ife, Nigeria. It is suggested that this model be used in other universities to build and strengthen internal capacity in similar disciplines, as the project combined the three components of capacity building in the execution of the projects.

The title of the project is "Climate Change, Climate Variability and Food Security in Sub-Saharan West Africa". This final title was arrived at after several interactions with the AIACC Science Director and his team. Obafemi Awolowo University, Ile-Ife, Nigeria is the administering institution. Other institutions that participated in the project are the University of Lagos, Lagos and the University of Maiduguri, Maiduguri, Nigeria. Although the main area of focus is sensitivity analysis and impact assessment, the analysis in the project also extends to assessment of the human development of peasant farmers.

The country of primary focus is Nigeria. The country was adopted as a sample area for sub-Saharan West Africa because the country represents the climatic profile from the humid to the semi-arid ends of the project region. All the indicator vegetation types of the various climate types are present in the country. Thus, northwards from the very humid, eastern, coastal locations, to the boundary with the desert, the vegetation profile includes Moist Evergreen Rain Forests, Dry Semi-Evergreen Rain Forests, Derived Savannah, Southern Guinea Savannah, Northern Guinea Savannah, Sudan Savannah, and Sahel Savannah (Adejuwon 2007).

One of the most important aspects of the project is capacity building. It was observed that the research culture at the university was at a low ebb when the project was approved for funding. There was a need to increase research activities

of scientists at the University. The fact that the country was yet to submit its first communication to the UNFCCC 10 years after the Rio Earth Summit is an indication of the status of research activities at the time. After examining the present situation at the university, it was observed that resident capacity for research on climate change has increased considerably compared with what obtained 3 years ago when the project was approved for funding (Adejuwon 2007). An indicator of this improvement is the increase in the number of participating researchers from seven to seventeen. The project was approved with only six core research staff apart from the Principal Investigator at inception.

In addition, the AIACC-organized workshops; the in-house project seminars; the 2-day stakeholders' workshop held from 20 to 21 September 2004; the stock of equipment including four desktop computers, one laptop computer, and one Powerpoint projector; participation by students, especially at the undergraduate level; the visit of Professor C.G. Knight from Pennsylvania State University; and the study visits of one of the students to the University of Cape Town, South Africa demonstrated the use of the three concepts of capacity building suggested in this study. One of the students who worked as a research assistant also presented a paper at the stakeholders' workshop. Three examples of success stories in capacity building can be cited. First is the generally high level of performance by the undergraduate students who opted for climate change as a specialty. One of them was awarded the third first class honours in the 43-year history of the Department of Geography at Obafemi Awolowo University (Adejuwon 2007). Second, a member of the Research Team was awarded a START Fellowship based on a proposal that was derived from the AF23 Project and his experience when he attended the AIACC Workshop in Trieste, Italy in 2002. Third, another member of the research team who was the most junior member is the sole author of three of the publications submitted with this report and a joint author of a fourth (Adejuwon 2007).

Conclusion

The focus of this paper is to examine how climate change projects within university systems can be used to develop and build capacities in the field of climate science. A case of the AIACC project in sub-Saharan West Africa situated at Obafemi Awolowo University was used to illustrate the model that can be used to achieve this goal.

It was found that the project incorporated all three components of capacity building suggested in the study. Assessment of the present situation in the university community of Obafemi Awolowo University, Nigeria in general, and the Department of Geography in particular indicates that resident capacity for research on climate change has increased considerably compared with what obtained before the project was approved for funding. We propose that the strategies used in this project to promote and build capacities in the area of climate change could be duplicated for projects in similar areas. Considering the fact that many developed

and developing countries are vulnerable to the impacts of climate change, albeit with different intensities, it is recommended that these countries adopt this triadic model so as to increase capacity, as well as reduce their levels of vulnerabilities to climate change impacts.

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