

Biodiversity reduction as a vehicle for exploring teacher thinking about issues in biological education.

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SUMMARY

The maintenance of biodiversity is central to future sustainability. There is also disagreement amongst experts about whether in fact there is a significant trend globally in biodiversity reduction and if so, whether this is mainly brought about by human activity. Traditionally biology teachers have an important role in biodiversity education. In the study reported here the contribution that study of biodiversity reduction could make to the biology curriculum of schools was investigated. The methodology involved participatory appraisal using focus groups of teachers.

The teachers found the process helpful in clarifying their own ideas about the value of applying a broad range of process skills to this type of topic. They also considered that it was a suitable vehicle for students to understand the provisional nature of scientific knowledge and the limitations of the contribution that science can make to the debate on possible solutions to the problem. There was also agreement that schools, as institutions, should be models of good biodiversity conservation in their management. The approaches used in the research facilitated wide-ranging discussions about the nature and purpose of biology education.

KEY-WORDS :- biodiversity reduction, participatory appraisal, teacher education, school teachers.

RESUME

La diminution de la biodiversité comme véhicule pour l'exploration des opinions des enseignants au sujet des questions dans l'éducation en biologie.

Le soutien de la biodiversité est fondamental à la subsistabilité future. Les experts se trouvent en désaccord sur l'existence d'une importante tendance mondiale à la diminution de la biodiversité, et dans le cas qu'elle existe, si ou non cette diminution résulte de l'activité humaine. Les enseignants de la biologie jouent traditionnellement un rôle d'importance dans l'éducation sur la biodiversité. L'actuel compte rendu examine la contribution que les études sur la diminution de la biodiversité peuvent apporter au programme scolaire de la biologie. La méthodologie comportait l'évaluation participative des enseignants en groupe.

Les enseignants ont trouvé le procédé utile pour l'éclaircissement de leurs idées sur la valeur d'appliquer une large gamme de compétences au processus d'apprentissage. Le groupe était d'avis que la diminution de la biodiversité représente un véhicule approprié pour permettre aux étudiants de comprendre le caractère provisoire des connaissances scientifiques et les limitations de la contribution que les sciences peuvent offrir au débat sur les éventuelles solutions du problème. Les enseignants étaient d'accord que l'école, en qualité d'institution, doit se présenter, dans sa gestion, en modèle correct de la préservation de la biodiversité. Les techniques choisies pour les recherches ont facilité des discussions de grande envergure sur la nature et l'objectif de l'enseignement de la biologie.

MOTS -CLES:

Diminution de la Biodiversité, Evaluation participative, Formation pédagogique, Enseignants.

The profile of biodiversity reduction has been raised by biologists (notably Wilson, 1988¹ and 1992²) and on the international political agenda, particularly over last decade. The maintenance of biodiversity has been identified as one of the central issues in pursuit of sustainability. It is also clear that the topic is a controversial one since a) experts do not necessarily agree that it is taking place or b) that even if it can be shown to be occurring, there is a question about whether it is caused mainly by human activity and c) there are significant social, economic, cultural, ethical and other issues involved, as well as the scientific, over which there is considerable disagreement.

Despite the lack of unanimity of agreement amongst experts over the matter the United Nations (1992³) and others have supported the notion that reduction in biodiversity is occurring and that the participation of all citizens is essential if the situation is to be improved. The importance of education for all is emphasised to create partnership in the process.

The research reported in this article also had as the underlying intention of challenging the belief that the main purpose of education about important controversial issues, such as biodiversity reduction, is to persuade people to behave in a more responsible way towards the environment. This is now considered to be an out-moded idea and not in line with the aims of a rationale education, however well intentioned the action.

The research reported here began with a particular observation common in much biological research. Frequently the process of investigation itself influences the outcome; consequently the research loses validity. Therefore methodology is especially important to ensure that the process of the enquiry causes minimal interference. This was an essential aspect of this research.

Since biology teachers are normally identified as having a particular responsibility for biodiversity education this study focused on these teachers. The rationale was to find out what a selection of biology teachers in a region of Southern England considered would constitute good biodiversity education and how the quality of teaching and learning might be evaluated. These teachers were not selected to be representative of biology teachers. All of them were teachers of students of 11-16 years and in many cases students up to 18 years.

The use of participatory appraisal methods and ‘focus groups’

The methodology involved the use of participatory appraisal methods based on principles developed mainly by Chambers (1992⁴) in rural extension work. The research

¹ Wilson, E.O. *Biodiversity*, Washington, D.C. : National Academy Press, 1988.

² Wilson, E.O. *The Diversity of Life*, Boston, U.S.A. : Harvard University Press, 1992.

³ United Nations. *Agenda 21: Programme for action for sustainable development*. United Nations Conference on Environment and Development, New York, U.S.A. : United Nations Publications.

⁴ Chambers, R. ‘Rural appraisal: rapid, relaxed and participatory’. *IDS Bulletin* 333, Brighton: Institute of Development Studies, University of Sussex.

was intended both as a method for investigation but also as a possible process for the professional development of the teachers involved. This method of enquiry required the researcher to:

1. consider the situation as it already exists in schools rather than suggest an ideal situation,
2. avoid prescribing what constitutes good biodiversity education or how it should be evaluated,
3. offer teachers the opportunity to reflect on their own practice with peers,
4. invite teachers to identify their own criteria for making judgements about what constitutes good practice and to suggest approaches to evaluation of practice.

The role of the researcher in using this approach was important and throughout required keeping a low profile, listening and acting as a facilitator rather than making judgements or offering opinions. Also encouraging the teachers to develop a sense of 'ownership' for the research and to participate in the analysis of the findings and to draw their own conclusions. An additional purpose of the study was to allow teachers the opportunity to explore ideas about biodiversity education and to broaden their thinking about the scope of the topic and the teaching approaches that might be used. Using this approach it was intended that teachers would find this an effective way of learning from each other and therefore it would be an effective way of assisting their professional development.

With regard to the use of focus groups, a technique used widely in market research (Hillcoat *et al.*¹ 1995, Gayford 1996²) there were a number of advantages in the context of the present research. The small size of the groups (with only four or five in each group) allowed interaction between participants who considered themselves to be peers. The method acknowledged that teachers are particularly ready to listen and learn from each other. It also was a further way of keeping the researcher in a sub-dominant position.

The methodology

To begin the research a small panel of biology teachers were invited to decide on the way in which the topic should be approached in the focus groups. Initially the following broad question was suggested: 'what contribution should biological education make to educating students about biodiversity reduction?' However, after further consideration the question was changed in a significant way to: 'what contribution should the inclusion of biodiversity reduction in the curriculum make to biological education?' The panel went on to suggest a series of supplementary aspects to the topic which they wanted discussed. These are summarised as follows:

1. How can biological education retain its integrity as a subject discipline and help to address the issue of biodiversity reduction?

¹ Hillcoat, J., Forge, K., Fien, J. and Baker, E. 'I think that it is really great that someone is listening to us... young people and the environment', *Environmental Education Research*, 1(2), 1995, pp. 159-172.

² Gayford, C.G. 'Environmental Education in Schools: An Alternative Framework', *Canadian Journal of Environmental Education*, 1, 1996, pp. 104-120.

2. What fundamental biological knowledge and understanding should be included?
3. What broader scientific skills and abilities can be developed through the topic?
4. How can the topic be used to help students understand the nature of scientific enquiry and evidence?
5. How can biology teachers address a topic, such as biodiversity reduction, where there is controversy, in which experts do not agree, where non-scientific aspects have an important bearing on the matter and where the formation of balanced opinions is essential?
6. How can biology teachers best be supported in their role as educators about biodiversity?

The study reports the findings from discussions among five focus groups. Each group met three times for a couple of hours each and the whole study extended over nine months. At each meeting the researcher was present and took extensive notes, summaries of which were agreed with the group after each session. The next section of this article contains an outline of the aspects of the discussion that focus groups selected as the most important.

The findings from discussions within the focus groups

At the beginning there was considerable discussion among the teachers about their own level of understanding of the nature biodiversity and its importance both globally and locally. From these discussions it was apparent that the teachers were generally knowledgeable about the topic and had an appreciation of the implications of maintaining interspecific and intraspecific diversity as well as diversity of habitats. In their minds this was not confined to exotic species and distant habitats but also affected more familiar organisms in local environments. It was clear that they considered these to be a matters of great importance not only scientifically but also socially, economically, aesthetically and ethically. However, they did not think that it was the role of schools to solve political problems but to be places where good teaching and learning take place. They also considered that whilst they may work collaboratively with teachers from other disciplines to address the full range of aspects to the topic, including the non-scientific; within their biology classes their main focus must be upon the biological elements of the topic.

The teachers then went on to discuss the pedagogical implications of the topic. The following is a summary of those aspects over which there was general agreement. They began with what they considered to be the essential elements of the content which they thought was already embedded within the subject matter of most biology courses at their level. These included such the topics as :- the variety of living things, genetics, ecological genetics, ecology, the impact of human populations on the environment and animal and plant populations and the importance of biodiversity in the maintenance of a sustainable environment. In one focus group some of the members constructed a concept map to show how these topics could be effectively linked in their teaching programs.

Within the focus groups considerable attention was then given to the skills and abilities that could be developed. Again it is probably most helpful simply to summarise these as helping students to be able to engage in the following :

1. dealing with a complex body of information, to be able to simplify it and identify the main principles involved, yet still retain an appreciation of the complexity of the issue,
2. considering evidence and from this make predictions and suggest conclusions,
3. thinking holistically by seeing how one issue relates to another; thus for example, reduction of biodiversity relates to aspects of global climate change, pollution, tropical deforestation and so on,
4. accepting that there may be different points of view that should be considered in which controversy exists and even experts do not agree,
5. dealing with knowledge and opinion where there is an interface between scientific ideas and non-scientific ideas and that one does not have supremacy over the other,
6. appreciating that scientific knowledge is evolving and developing and that current knowledge is provisional,
7. accessing information in order to be able to follow a debate and to be able to evaluate the information found and communicate it to others,
8. appreciating the limitations and contribution of scientific biological knowledge in the solution of problems of this kind.

They also developed criteria for identifying what they considered to be suitable practice in schools. Some of the most important outcomes were related to a perception that the whole school as an institution, not only across the whole curriculum but also in the management of the school, should become a model of good practice in supporting the maintenance of biodiversity.

Concluding findings

The teachers also wished to make it clear that whilst they considered themselves to be reasonably knowledgeable about the topic from a biological point of view, and they were able to make up deficiencies by reading and discussion with other teachers, they felt much less confident about methodologies for teaching controversial topics with important non-scientific elements. They also considered that it was unfair to expect schools and their students to find solutions to difficult problems of this kind that are basically political, social, economic and ethical as well as scientific. The teachers considered that biology teachers could make a special contribution to the topic but whole schools can and should contribute to a broad range of activities related to biodiversity education. Biology, as a subject was well placed to provide teaching which covers a range of knowledge, understanding, skills and abilities which have a general application and can be developed effectively through teaching this topic.

Concluding comments

One of the most important outcomes of the study was that it provided evidence that the methodology used was particularly effective in supporting the biology teachers' professional development. Not only did the teachers learn well in the group situation, so that their subject knowledge was considerably enhanced but also they were able to

explore ideas about teaching methodologies appropriate to the nature of teaching a controversial issue, such as biodiversity reduction. Several of the teachers commented on the fact that they thought this was a particularly effective way to help teachers to focus on methodological matters and in particular on a range of skills objectives that might otherwise be under-emphasised at the expense of the subject content.

This approach also encouraged wide-ranging discussion about some of the general and deeper issues of education. Among these were issues related to the nature of knowledge itself, the impact of post-modern thinking which challenges the notion that knowledge is cumulative and progresses in a linear way. That there is the possibility of many different interpretations of a situation and there may not be one particular 'right way' to arrive at a conclusion. The teachers also challenged ideas about the purpose of scientific-biological education in which it may be used to persuade people to think in a particular way. There was a view expressed by several that the purpose should be more emancipatory and give students the abilities to explore and arrive at their own understanding, attitudes and values.