Basics of Biology – Living Things

The conversations of English primary school children, and the adults accompanying them, at plants and animals in museums, zoos and gardens

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SUMMARY

It is very important for the future of biology that pupils learn about organisms, plants and animals, These exhibits in natural history museums, zoos and botanic gardens tell a story which is interpreted in a different way by the visitors. The visits do not always interpret the organism and exhibits in the way intended and bring their existing knowledge to this. This is the challenge of the new century biology education. To learn about living things

KEY WORDS

plants, animals, children, learning, biology, education

RESUME

C'est très important, pour le future de la biologie, que les élèves apprennent a partis des organismes, les plantes et les animaux. Ces expositions, le musée d'histoire naturelle, le jardin zoologique et un jardin botanique, nous racontent un passé qui peut être interprété d'une manière différente par les visiteurs. Cependant les visiteurs ne peuvent toujours pas interpréter la nature d'une exposition de manière objective, compte tenu des idées préconçues, basées sur leur connaissances personnelles acquises au préalable. C'est le défi du siècle qui s'ouvle, apprenent a partis des organismes.

MOTS CLES

les plantes, les animaux, biologie, les élèves, éducation

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Introduction

As a biology educator I wanted to find out:

a) whether children (and the adults with them) spontaneously noticed the criterial attributes of animal and plant specimens which I did or whether these specific features have to be taught
b) what names they allocated to the animals and plants, known and unknown.

Before people can appreciate biological advances they need to have an understanding and familiarity with living organisms. This knowledge is obtained through a variety of means but particularly through school and, more often, home (Tunnicliffe and Reiss 1999[1]). This paper is concerned with the effectiveness of 'museums' in getting across a message about biodiversity of living things. It is important to appreciate that learning about biology occurs not only in the classroom but outside them too.

Although some schools do use their school grounds for studies in biology and environmental education nearly all schools organise visits to sites such as natural history museums, botanical gardens, zoos, aquaria and nature and field centres. Such visits may form part of the teaching for a particular topic or they may be primarily regarded as social trips. When the visits are organised for curriculum purposes what do the groups, pupils, chaperones and teachers, talk about. Is biology education happening or are the participants just looking and commenting in an everyday way? Are visits to places to view biological organisms missed educational opportunities? [2] It is important for biology education that we know what is happening on such visits so that we can develop strategies for the 21st century and effective biology education.

Method

There are a great many ways of analysing conversations e.g. Tunnicliffe and Reiss, 1999[3]). In the study reported in this paper, the same method, that of a systemic network, was used. A systemic network is a means of grouping or categorising things, in this case conversations, to be a parsimonious representation of the data, while preserving the relationships between categories in such a way that comparisons can be made between groups.

It is a type of analysis that changes qualitative into quantifiable data and each topic of conversation was coded according to the systemic network designed for the studies. The network can be regarded analogously as the sets of nested boxes into which the researcher puts each part of the conversation and sections are presented in Figure 1. There were 56 categories in this network some of which are shown in figure 1. A bar, '[', indicates that an attribute may be either/or but not a member of both categories, whilst a bracket, '{', indicates one of a number of categories which an organism may have. A theoretical 'waste basket category' for topics such as security alert announcement comments and which were uncategorised was provided.

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1 Tunnicliffe, S.D. & Reiss, M.J. (1999) Building a model of the environment: how do children see animals? Journal of Biological Education. 33 (4) 142-148

2 Tunnicliffe, S.D., Lucas, A. M. & Osborne, J. F (1997). School visits to zoos and museums: a missed educational opportunity? International Journal of Science Education, 19 (9), 1039-1056.

3 Tunnicliffe, S.D. & Reiss, M.J. (1999d) Talking about Brine Shrimps: Three Ways of Analysing Pupil Conversations. *Research in Science & Technological Education. 17 (2) 203-217*

Plants

The conversations of small groups within school parties the Royal Horticultural Society Gardens, Wisley, Surrey, were listened to and recorded by hand. Tape recording had proved too difficult in a pilot study because of interference, in particular the distance between young visitors and other noises.

The field notes were transcribed as soon after the visit as possible. To facilitate the analysis of the transcripts the data were considered in terms of units of conversations. A unit of conversation was defined as the 'group conversation in front of any one exhibit from the beginning of the conversation until it ceased or the conversation could no longer be heard without the researcher being intrusive.' The units of conversation were identified during the typing of the transcripts from the 'voices' of the different members of the group. An example of a unit of conversation is shown below. Detail of the network is shown in Figure 1.

Year 4 children (7 to 8 years old)

115	Teacher	Through there are lots of flowers - what are they called?
	Girl	Roses
	Teacher	We'll see some more later
	Boy	I had a yellow one in my Grandmas and Grandpa's garden
	Teacher	Really? We're going to see them.

Figure 1
Part of the systemic network used in analysing the content of the conversations of the groups

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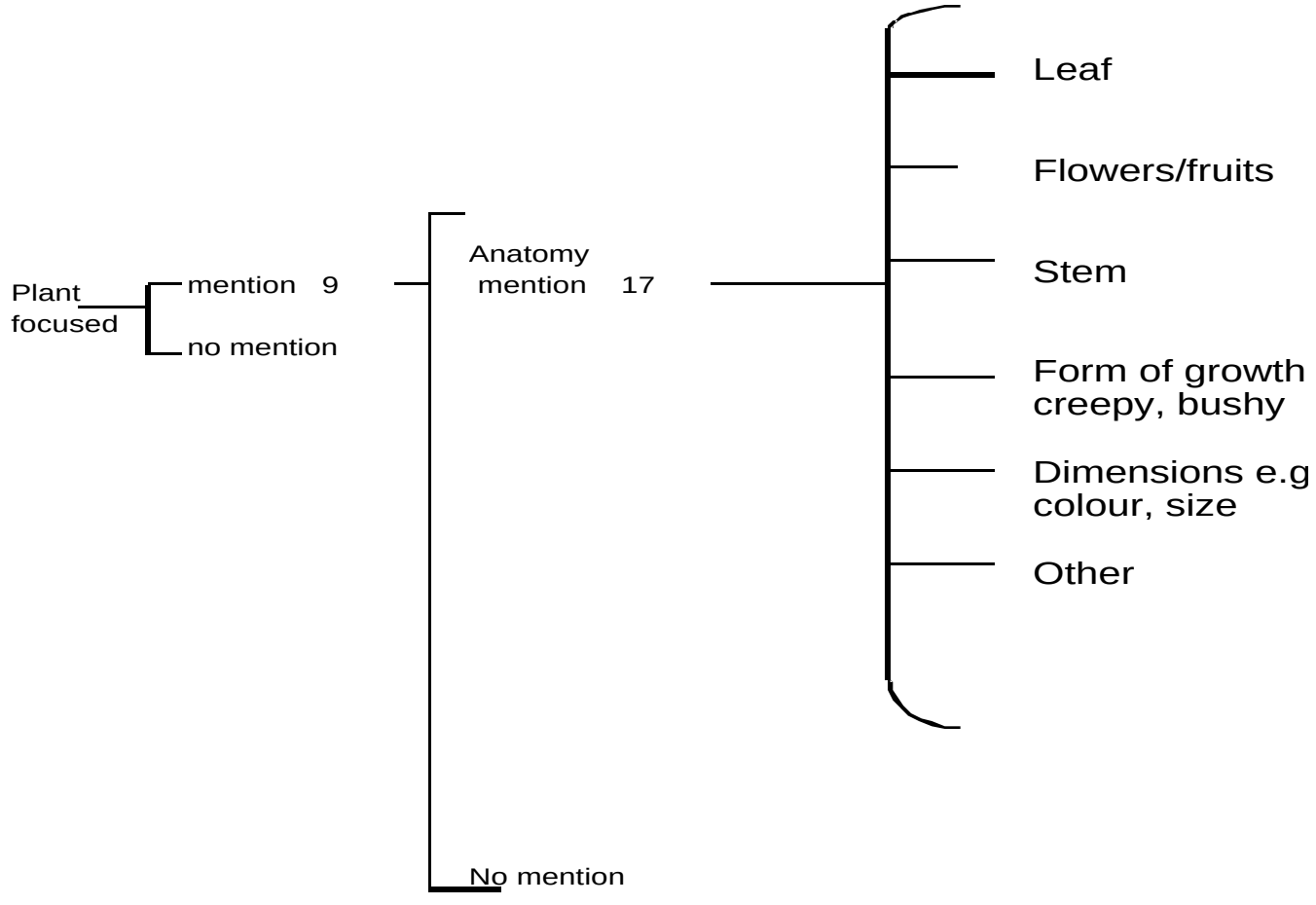

The three main super ordinate categories were 'exhibit focused comments', 'management and social comments' and 'exhibit access' or 'orientation comments' in which visitors searched for or located the plants. The comments directly referring to the exhibits were divided into 'other exhibit' comments, such as artefacts which were features of exhibits such as gravel or a statue or biofacts such as animals seen amongst the plants such as frogs in the pond) and those which focused on plants. The plant-focused category was subcategorised into four subordinate groups:

1. other interpretative comments, which included knowledge source comments such as questions and references to a source of the information proffered;
2. affective comments which included emotive responses such as 'Ah!' or 'Ugh';
3. environmental comments referring to the natural habitat or endangered status of the species; 4• comments about the actual plants- names, structure of physiology which formed three subsections.

The conversations were coded using the number of the relevant category which was written above th appropriate words on the transcript. An entry was typed into the columns within the spread sheet of Minitab. Hence, a sentence from one of the above conversations from Wisley received the following codings.

115		6	19	44
	Teacher	Through there are lots of flowers - what are they? called?		
		29/32		
	Girl	Roses		

If more than one comment of a particular category (e.g. a name) occurred within a single conversation, it not scored again. Hence the analysis shows the number of conversations within which a topic is mentioned not the number of overall times that a topic is mentioned.

Animals

A network similar in form to that for the plants was used in analysis of the animal conversations. Detail is available in Tunnicliffe [4]1995. The three main super-ordinate categories for the animal conversations collected at the natural history museums or a zoo were , as for the plants, 'exhibit focused comments', 'management and social comments' and 'exhibit access' or 'orientation comments' in which visitors searched for or located the animals were another super-ordinate category and exhibit focused comments. If more than one comment of a particular category (e.g. a name) occurred within a single conversation, it not scored again. Hence, the analysis shows the number of conversations within which a topic is mentioned not the number of overall times that a topic is mentioned. The animal-focused category was subcategorised into six subordinate groups: 1. interpretative comments, which included knowledge source comments such as questions and references to a source of the information proffered; 2. affective comments which included emotive responses such as 'Ah!' or 'Ugh'; 3. environmental comments referring to the natural habitat or

[4] Tunnicliffe, S.D. (1995). Talking about animals: studies of young children visiting zoos, a museum and a farm. Unpublished PhD thesis, King's College, London.

endangered status of the species; 4. comments about the animals' structure; 5. comments about the animals.; 6. comments about the animals' names.

Results

Plants

The data show that overall 95% of conversations were focused on the exhibits- the gardens and the plants- and 79% of the conversations contained a comment about a plant. Anatomical features of plants occurred in 51% of all conversations whereas only 9% referred to a physiological function and 54% named in some ways a plant. Emotions and affective attitudes are not predominant in conversations and only 19% of the exchanges expressed an ambition. Overall , 64% of conversations were of some type of interpretative nature with 48% being of 'other interpretative nature' which includes 47% being a knowledge source comment- a question or a statement, 3% discussing the reality of the specimen. Only 3% mentioned an environmental issue, such as the natural habitat or the conservation issues associated with the plant- which is a feature of Wisley Horticultural Gardens. However, 23% of the conversational exchanges considered the human plant relationship, most often as in the second conversational example, these were about the speaker's relationship with the plant through gardening at home.

The groups commented mostly about anatomical features of the plants of which 13% of all conversations mentioned leaves, 20% flowers or fruits whilst 4% mentioned the stem. The features mentioned had to stand out from the rest of the plant. As for example do the leaves of *Gunnera.*

358	Boy (8 year old)	Wow! Look at those leaves. I have seen one plant like that but not such big leaves!

The dimensions of the plants, their colour or size, were mentioned most of all and this occurred in 26% of all conversations. Other comments occurred in 7% of conversations and were about items such as prickles. The most frequent function of plants which was mentioned was growth, in 9% of conversations, followed by food at 3% and 'other' including reproduction in 5%.

Sometimes the teachers gave the children the information but on occasions they drew the As other researchers have found, the opportunity to interact with the plants with more than the sense of sight is an important part of the experience of visiting the gardens and part of learning about biodiversity Animals stole the limelight from plants if they were present. If there were an animal moving, the attention of the groups was immediately diverted from static plants.

The data show that the visitors comment about salient features and seek to explain that which they see from their previous knowledge and understanding. Adults and pupils feed the conversation of each other on occasion but also speak in statements with a series of statements which may not be linked in thought development. Similarly at the gardens the same type of pattern of comments were heard but there were less comments about gardening and active involvement with plants. Human /plants relationships were mentioned in 14% overall of conversations but the environment, including conservation, only 8%. Just over a quarter of conversations contained at least one affective comment. The visitors talked about the plants in 87% of conversations.

Animals in the Natural History Museum and Zoo

The data suggest that the museum presented an environment more conducive to looking and discussing the specimens without additional distractions or need for control. In contrast the school visitors to live zoo animals generated significantly more conversations that contained at least one

reference to exhibit access, (77%) presumably because the live animals were more difficult to locate within exhibits, which in turn is a reflection upon the design of the exhibits. Both groups generated emotive comments to the same extent (31 % and 35%).

The significantly higher number of comments about environmental issues in the museum (11%) at the preserved specimens is also surprising (4% in zoo. All conversations focused on observations of animals, a prerequisite of biodiversity understanding. However, the data show that the difference in the type of specimen, preserved and static, or live and potentially moving, engendered a difference in emphasis of conversational content. Overall naming comments did occur in similar amounts, * 87% zoo, 86% museum) the groups in the museum had a similar variety of specimens to observe as did the zoo groups, but the traditional museum specimens were readily visible, and the museum visitor categorised and compared animals significantly more, although the associations were weak in absolute terms (41% museum; 19% zoo).

Specimens were located nearer to each other in the museum which may account for some of the comments that compared animals. Unfamiliar parts of animals were noticed significantly more than in the zoo (17% compared to 7%) because these parts were easily viewed on a static specimens in an exhibit *designed for visitors to observe* closely. Attracting behaviour such as fighting and movement were, not surprisingly, mentioned significantly more for the live animals (25% and 28%) and behaviours were referred to more (66% compared with 37% in the museum which is a surpassingly high proportion of conversations because the animals did not move). The museum exhibits tended to generate longer conversations than did those of the zoo.

DISCUSSION

The main points drawn from these studies are that

Lack of biological education focus amongst conversations of school groups

Since pupils are visiting the exhibits as part of their formal educational entitlement, ascertaining the content of the conversations of the three sub-groups of primary school parties is important in order that an effective educational experience can be provided for subsequent primary school visitors. There is a everyday commentary generated at plant and animal exhibits. This commentary is altered somewhat *either* when there is a definite educational objective that is stated by the teacher *or* the group is led by a teacher used to focusing the attention of pupils.

Lack of talking science

Children do not spontaneously and are not encouraged to raise questions formulate hypothesise and observe, gather data and then evaluate. Very occasionally children were thinking at this level and with appropriate support from a teacher could have developed the theme.

Visits are missed opportunities for learning biology

Categorisation and hence knowing about biodiversity requires comparison with other species to identify whether the animal has the criterial attributes essential for its class and relies on observing anatomical features and behaviours. Pupils can maximise learning by using observational opportunities to reinforce school work. School visits have a surprising uniformity in content of conversations irrespective of the composition of the groups. Scientific concepts have to be developed by pedagogic techniques.

The visit experience itself, whilst highly enjoyable, is overwhelmingly a missed opportunity when schools and museums fail to capitalise on its learning potential.

Being a member of a social group is not sufficient alone to bring about learning, additional interpretation and guidance to the subject being studied is required. Providing or facilitating an affective experience is an insufficient warrant for institutions whose primary mission is above all else, educational. The affective domain could serve as the starting point in an educational programme which would lead pupils into learning other aspects of zoological science relevant to their ages. Visitors to and zoos, natural history museums and botanical gardens construct their own meaning about the organisms from their own knowledge and experiences, including allocating the specimen to a familiar category when they do not know the scientifically correct one. The role of the teacher who organises a school visit should be to help their pupils enter into meaning; part of the way to achieve this objective is to ensure that all other adults who will be working with pupils whilst the school parties are in the zoo, natural history museum or botanical gardens have an understanding of both the subject matter and the key teaching strategies which can be applied to assist the pupils in their learning. Neither children, nor the majority of adults accompanying them, do not spontaneously notice the features important to biologists and used in taxonomy nor do they approach the identification of organisms in a systematic way.

If biodiversity education is to advance and be key in conservation education, zoos, museums and botanical gardens need to be more effective in assisting their visitors in establishing the rudiments of biodiversity knowledge. The first step in this process is establishing, as I have done in this paper, what it is the visitors note and subsequently, through various techniques and strategies, building on this base. Promoting the effective study of living things is the basic challenge for biological education in the 21st century. Without success in this area there will be little biological understanding in our societies.