Nature's Technology: A Case Study in Materials Modification

Richard Watson Todd
Department of Applied Linguistics, KMUTT

Abstract: Materials modification involves modifying an extant set of language teaching materials to improve their quality and suitability, and is probably the most frequent activity concerning materials undertaken by teachers. It has, however, been underreported in the literature. This paper presents a case study of materials modification by examining attempts to produce a suitable set of materials to accompany a video in an EAP course. Four sets of materials were produced, each attempting to improve on the previous set. The thinking behind the sets of materials and their effects on the learners are described. A model of the process of materials modification is proposed which highlights the need to evaluate both strengths and weaknesses in materials and to identify the heuristics behind materials modification.

For many teachers, the materials provided dictate the sequencing, methodology, pacing and content of their lessons (Skierso, 1991). Thus, the effectiveness of learning is often predicated on the quality and suitability of the materials provided. While quality and suitability of materials includes the global level of syllabus which has been extensively covered in the EFL literature, the specific levels of materials design have largely been overlooked. These specific levels include the appropriateness of questions asked about a text, the degree of fit between an activity type and an objective, and the language used in rubrics. This paper describes a case study in materials modification at a specific level by following the attempts of a group of teachers to produce a satisfactory task to accompany a video.

Materials modification

As has been noted, most EFL literature concerning materials has focused on global considerations. Thus there is a plethora of literature concerning syllabus/materials evaluation (e.g. Cunningsworth, 1995; Dubin & Olshtain, 1986; Rea-Dickens & Germaine, 1992) and large-scale materials design (e.g. Foster, 1980; Hawkey, 1984; Hutchinson & Waters, 1987). This literature usually focuses on more theoretical considerations external to the classroom such as syllabus rationale and availability of materials. The nitty-gritty world of materials development and use in the classroom is largely underreported (Nunan, 1991), in spite of its vital importance to teachers. In many situations, teachers have little or no control over the syllabus, but do control the implementation of the syllabus in the classroom at a specific level. Thus, although the global theoretical considerations may be of interest to a syllabus/materials designer, most teachers are far more concerned with specific practical considerations.

One particularly important way in which teachers concern themselves with materials is materials modification. I am using the term materials modification in contrast to materials design and materials adaptation. Materials design is generally taken to include the whole process of writing materials from scratch, including setting up a rationale and a table of specifications, finding appropriate texts, and setting global objectives. With materials adaptation, on the other hand, the teacher usually already has a text and needs to match the text with a rationale and to design activities to exploit the text. In contrast to these, materials modification is more humdrum. The teacher modifies an existing set of texts and activities, such as those found in a textbook, to make them appropriate for her classroom by, perhaps, altering the sequencing of activities, supplementing the materials with extra activities, changing some of the questions in the materials, and so on.

Materials modification, then, is probably by far the most frequently undertaken of the three things that teachers may need to do with materials. As has been noted, however, the importance of materials modification is not reflected in the literature, so teachers have not received sufficient support in this vital area. I therefore hope that the following case study may help us as teachers to reach a greater understanding of what is involved in materials modification.

The situation

The case study in this paper concerns one two-hour lesson from a 60-hour English for Academic Purposes support course for mixed-ability engineering and science postgraduates at King Mongkut's University of Technology Thonburi, Thailand. The course takes the form of a large-scale project on the theme of robots (for a full description, see Watson Todd, 1995) and aims to give the learners a firm grounding in the language and study skills needed for academic success.

One of the language skills covered in the course is listening and note-taking from lectures. The learners are prepared in both bottom-up and top-down listening skills (see Richards, 1990) and in note-taking strategies over three two-hour lessons. They then practise these skills while listening to a technical lecture in English followed by a feedback session. For further practice, and for variety, it was felt that a video would be appropriate and beneficial (Nunan and Lamb, 1996).

The video chosen is *Nature's Technology*, originally broadcast as part of the *Equinox* series on Channel 4 of British television, and then made available as a video. The video was chosen for its relevance to the theme of the course (Robots) and for its intrinsic interest and authenticity. The main theme of the video is how scientists have applied principles from animals in the design of robots, for example, basing a manipulative robot on the principles of the elephant's trunk, and designing a bipedal walking robot. The video, designed for broadcast to a native speaker audience, obviously makes no concessions regarding language, and follows a traditional documentary format interspersing explanatory narrative

with interviews with scientists involved in robot design. The video lasts roughly one hour, divided into two halves, the first about designing robots for manipulation and the second about walking robots with legs.

Background to materials

Having found a visually stimulating and thought-provoking video on a relevant topic, the problem facing the teachers was how to exploit the video so that the learners gained as much as possible from watching it. The initial task of converting a documentary video into material for the language classroom involves materials adaptation. The first step in materials adaptation involves identifying objectives and assessing the fit between the text and the objectives (Brown, 1995).

The overall aim of using the video is to enhance the learners' listening and note-taking skills. More specifically, these language skills can be defined as listening with sufficient comprehension to gain the gist of the video, being able to distinguish between key and incidental elements of the discourse, being able to identify important information relevant to themselves, and being able to take efficient and effective notes on such information. In addition, it was hoped that the learners would be reasonably successful at understanding the video, with attendant affective consequences on their future listening performance.

Clearly, to achieve these objectives, the video alone is not enough. Some exercise is needed to provide support for learners, to allow them to evaluate their listening ability, and to provide a basis for feedback. These exercises designed by the teachers to accompany the video are the focus of this paper.

Materials Set 1

In spite of the awareness of the need to meet the objectives stated above in the materials accompanying the video, practical constraints (see Maley, 1984; Maley and Grellet, 1980) interfered with the teachers' ability to produce an initial set of satisfactory materials. The video was obtained two days before the lesson was to be taught, and due to other work commitments, only one teacher was able to view the video and he only saw it once. Materials Set 1, then, was produced under some duress and simply consisted of a series of questions highlighting the key points of the video (see Appendix).

On teaching using Materials Set 1, it was found that the learners had great problems understanding the video, and that the materials did not provide enough support to aid their comprehension. Most learners took no notes and made no attempts to answer the questions. They were not able to gain the gist of the video, distinguish key elements, identify important information or take effective notes. Their lack of success in understanding the video could also have adverse consequences on their attitudes. Clearly, the materials accompanying the video were inadequate, and so before the next time the lesson was taught, the materials were modified.

Materials Set 2

It was felt that the main problem with Materials Set 1 was the lack of support to aid learners' understanding, and thus the materials modification focused on providing more support. This was done in three ways. Firstly, pre-viewing materials focusing on key vocabulary items and linking the video to other lessons in the course were provided. Secondly, the materials divided the video into sections so that the learners knew what exercises related to what parts of the video. Thirdly, the activity types used (gap-fill, sentence completion and answering questions) provided more support by reducing the task load of the learners.

Materials Set 2 (see Appendix) proved more successful than Materials Set 1 in that around half of the learners could complete most of the exercises. Furthermore, most learners stated that they could understand some of the key points in the video. Thus, it seemed that Materials Set 2 facilitated the learners' listening comprehension more than Materials Set 1, but further modifications to increase the proportion of learners successfully completing the exercises and to increase the amount of the video the learners understood were needed.

Although Materials Set 2 was moderately successful regarding listening comprehension, its effects on the learners' note-taking skills were minimal. The activity types dictated which information on the video was important, rather than allowing learners to identify information relevant to themselves. Furthermore, the processes required for answering the activity types did not provide any practice or lead to any deeper understanding of note-taking skills.

The modifications made to Materials Set 1 in producing Materials Set 2 appear to have been of mixed value. Dividing the video and the accompanying materials into sections and previewing the content and language probably helped the learners. The activity types used provided some support but did not meet the objectives set. Further modifications were required and the effects of the previous modifications needed to be taken into account in the new materials.

Materials Set 3

Materials Set 3 (see Appendix) retained the principles of previewing the content and the language and of dividing the video into sections. These two principles were also combined in that the two parts of the video were previewed separately. The main difference between Materials Set 2 and Materials Set 3 was the activity types used.

The activities in Materials Set 3 specifically aimed at note-taking. There was less guidance concerning the content to write about so that the learners had to decide for themselves what was important. Furthermore, rather than using, say, a gap-fill exercise, the learners were required to take full notes. It was therefore hoped that

materials Set 3 would provide meaningful practice in note-taking as well as listening.

Although Materials Set 3 was reasonably successful in achieving the note-taking objectives, as with Materials Set 2 only half of the learners completed most of the exercises. This was regarded as a problem of Materials Set 2 and the lack of learner improvement with Materials Set 3 was disappointing.

Learners' positive comments regarding their enjoyment of and interest in the video (even if they did not understand very much) suggested that the video should be retained in the course, but the lack of learner success in comprehension meant that further modifications to the materials were necessary. Even though Materials Set 3 provided meaningful practice in note-taking, this practice was restricted to those learners who understood enough to attempt to take notes. Further support for listening comprehension would need to be incorporated into the materials.

Materials Set 4

With the modifications leading to Materials Set 4, a watershed was reached. It became apparent that little further support was possible if the video could only be played once. Playing the video twice, however, would mean that more than one two-hour lesson would need to be devoted to the video and this would affect other lessons in the course. Given the learners' positive reactions to the video, the teachers felt that it was worth devoting the extra time to the video.

Materials Set 4 (see Appendix), then, differed from the previous sets in allowing the learners to view the video twice. It was decided that the first viewing should allow the learners to enjoy the video without unduly worrying about completing any exercises. Thus the exercise for the first viewing simply involved the learners in ticking the names of robots and animals they saw. Without the pressure of any more complicated exercise, it was hoped that the learners would enjoy the video and gain a tentative grasp of its content.

The two beneficial effects of previous modifications, previewing the language and content and dividing the video into sections, were again retained. For the second viewing, however, the video was divided into ten sections, each of approximately five minutes, compared to the two or three sections previously. Each section contained one main point of argument, so it was hoped that by dividing the video in this way, the learners could concentrate on taking notes on one point at a time, thus aiding comprehension. As with Materials Set 3, to promote note-taking skills the activity type consisted of a prompt or topic on which the learners should take notes.

In the classroom, Materials Set 4 resulted in more successful learner outcomes. Every learner attempted to take notes in at least some of the sections, with most learners taking notes for nearly all sections of the video. It proved impossible to

assess the quality of the notes, since the learners had different background knowledge and interests so different aspects of the video would be of relevance to them (Sperber and Wilson, 1986). However, the notes taken generally extracted some key points from the video and exhibited the characteristics of 'good' note-taking, such as a helpful layout and the use of note-form English and abbreviations (Byrne, 1988; Chaudron et al., 1994). Furthermore, in feedback sessions after viewing, the learners showed understanding of much of the content of the video and pride in the level of comprehension that they had achieved. Thus Materials Set 4 can be deemed to have met the objectives set, and can be regarded as appropriate and successful.

Discussion

The process described in this case study started with the identification of objectives. These objectives were used in the initial production of Materials Set 1 and also as a benchmark against which all sets of materials were evaluated. Following production of the materials, they were tried out and evaluated.

The evaluation allowed the teachers to identify both the strong and the weak points of the materials. The strong points were retained in any subsequent materials modification, while heuristics for overcoming the weak points were identified and incorporated in the new materials. If these heuristics proved useful, they would be retained in any subsequent materials or perhaps emphasised even more in further materials. For example, the usefulness of dividing the video into sections was identified in Materials Set 2, retained in Materials Set 3, and emphasised by dividing the video into more sections in Materials Set 4. There is, however, a limit to the extent to which any heuristic can be incorporated into materials – dividing the video into 100 sections would destroy any continuity and obscure the key points.

Materials modification, then, involves evaluating extant materials against some given objective, identifying strengths and weaknesses, retaining or emphasising the strengths, identifying heuristics to overcome weaknesses, and implementing these heuristics in subsequent materials. These steps are summarised in Table 1. below:

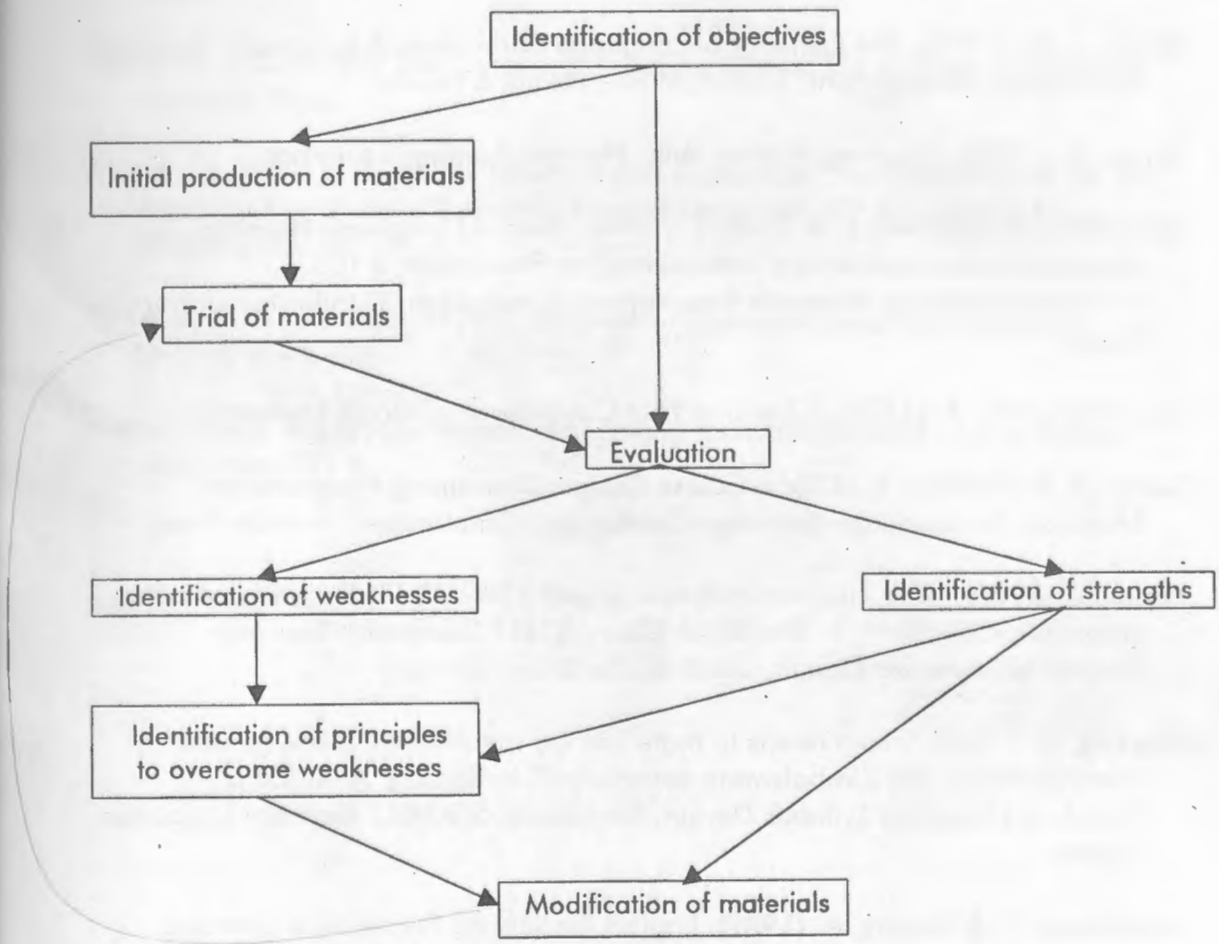

Table 1. *The process of materials modification*

There are two important points in the process of materials modification discussed here that need highlighting. Firstly, evaluation should not focus on weaknesses only. Identifying strengths in materials is vital as these strengths need to be retained in any subsequent materials and may also point to ways of overcoming any weaknesses identified. Secondly, in attempting to overcome weaknesses in materials, the objectives of the materials must always be borne in mind. These objectives may facilitate the generation of heuristics which guide materials modification. The effectiveness of the application of these heuristics can then be evaluated, and, if the heuristics prove useful, they may guide further materials modification.

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Appendix

(Note: Materials are abridged)

Materials Set 1

Video - Nature's Technology

1. Give 2 reasons for using robots.
2. What 4 of nature's devices have been copied for robots?
3. What are the three parts making up the structure of the elephant's trunk?
4. What is compliance?
5. Give three advantages of robotic limbs.
6. Why is the US army interested in robots with legs?

Materials Set 2

First, check that you know the following words:

device	manipulator	bellows
wire	tendon	muscle
flexible	solution	nature

Before watching the video, first look at the handout from 3 lessons ago. The list below contains the names of some of the robots mentioned in that handout. As you watch, tick the ones which appear in the video.

Tomovic hand	Utah/MIT hand
Terregator	One Legged Hopper
ALV	ASV

Part One of the Video

Section A

While watching this section of the video, fill in the gaps in the following eight sentences. If you can do this, you will have extracted some important information.

1. Robots do work for humans to protect us from hazards such as radiation and to carry out _____ and repetitive tasks in industry.
2. Scientists can either build and study robotic devices or _____ the behaviour of living creatures.
3. Engineering problems can often be solved by analysing the _____ of animals.

Section B

In this section you should try to complete the following sentences, in your own words if necessary.

1. Compliance means .....
2. The robotic limb based on the elephant's trunk is useful because it is ....
3. The military is interested in robots because ....

Part Two of the Video

Part Two is about scientists studying the movement of animals in order to build better moving robots. To help you understand this section, try to answer the following questions.

1. What are the two problems caused by using wheels for movement?
   .....
   .....
   .....
2. What are the two kinds of balance in animals and robots?
   .....
   .....
   .....
3. Why are robot engineers interested in copying horses?
   .....
   .....
   .....

Materials Set 3

Some Key Ideas

principles scientists animals robots

"_____ do work for humans to protect us from hazards such as radiation and to carry out boring and repetitive tasks in industry."

"_____ can either build and study robotic devices or analyse the behaviour of living creatures."

"Engineering problems can often be solved by analysing the successes of _____."

"What we as scientists are really interested in copying are _____, not specific devices."

Part One

Try to fill in the following table while watching the video.

IMAGE	HOW IMPORTANT AND WHY
Fly	
Robotic hand	
Robot painting car	
Prof. Jacobsen talking	
Baby walking	
Baby playing with bricks	
Man breaking bricks	

Part Two

Part two of the video is about movement in animals and robots. Think about these questions before watching this part of the video.

1. Why try to design a robot with legs instead of wheels?
2. What do you know about the different walking systems of animals and insects?
3. How many legs should the robot have?
4. What do you know about balance?

As you watch the video, try to note down the different machines you see and any information about them, e.g. the name of the machine, the number of legs it has, the problems it has moving. You can use the model below.
ATM: four legs; walks very slowly; can walk backwards; has driver inside machine.

Materials Set 4

Key Ideas

Fill in the spaces in the sentences below with the following words:

movement principles balance manipulation

1. "What we as scientists are really interested in copying are _____, not specific devices."
2. "For fast-moving animals with few legs, _____ is a problem."
3. There are two main classifications of robots: _____ and _____."

The first time you watch this video, try to understand the main ideas of how principles from animals are applied in robots. Don't worry about details.
Also while watching, tick which of the following robots and animals you see.

___ Tomovic hand
___ Utah/MIT hand
___ One legged hopper
___ Terregator
___ ALV
___ spider
___ bee
___ cow
___ kangaroo.
___ shark

For the second time we will play the video in sections. Try to take notes as you watch. We have given you some guidelines below. You can take notes in Thai if you want to.

Section 1
Reasons for examining animals:

Section 2 : Hands
The human hand:

Robotic hands:

Section 3 : The elephant's trunk
What it is made of:

Design of robot:

Section 7 (please complete the table below)

Name of robot	Number of legs	Kind of balance
General Electric Walking Truck		
Japanese quadruped		
Odex 1		