

## Learning Affordances of Video-Print combinations

Table 1, lists techniques and teaching functions that exploit the distinctive presentational attributes of TV.

**Table 1. Affordances of video – techniques and teaching functions enabling learning**

<p><b>1. Distinctive ways to assist LEARNING</b></p> <ol style="list-style-type: none"> <li>1 <b>composite pictures</b>, e.g. split screen, S/I</li> <li>2 <b>animated diagrams</b> exploring processes</li> <li>3 <b>visual metaphor/analogy/representation</b></li> <li>4 <b>illustrating</b> concepts with real examples</li> <li>5 <b>condensing time</b> by editing real life</li> <li>6 <b>juxtaposition</b> of contrasting situations</li> <li>7 <b>narrative power</b></li> </ol>	<p><b>2. Providing EXPERIENCES by showing otherwise inaccessible:-</b></p> <ol style="list-style-type: none"> <li>1 <b>movement</b></li> <li>2 <b>viewpoints</b> e.g. aerial, big close-up</li> <li>3 <b>3D</b> objects, using movement</li> <li>4 <b>slow/fast</b> motion</li> <li>5 <b>people/animals</b> interacting, real or drama</li> <li>6 <b>chronological</b> sequence and duration</li> <li>7 <b>staged events</b> e.g. dramatised enactments</li> </ol>
<p><b>3. SKILLS demonstration</b></p> <ol style="list-style-type: none"> <li>1. <b>manual/craft</b>: making teaching aids, hygiene, cooking, carpentry</li> <li>2. <b>body movement</b>: dance, athletic performance</li> <li>3. <b>reasoning</b>: techniques of problem solving</li> <li>4. <b>interpersonal</b>: counselling, classroom teaching</li> <li>5. <b>verbal</b>: foreign languages, singing</li> </ol>	<p><b>4. NURTURING (motivations, feelings)</b></p> <ol style="list-style-type: none"> <li>1 <b>stimulate</b> appetite to learn, e.g. fascinate</li> <li>2 <b>motivate a strategy</b> by showing its success</li> <li>3 <b>alleviate isolation of the distant learner</b> by showing the teacher or fellow-students</li> <li>4 <b>change attitudes</b>, engender empathy</li> <li>5 <b>reassure, encourage self confidence</b></li> </ol>

These 24 items are techniques and teaching functions that exploit video’s rich symbol system, e.g.

- moving pictures, real-life or diagrammatic, with synchronous words and actuality sound effects
- camera moves/zooms, big close-ups, evocative graphics, fabricated physical representations

This array of techniques and teaching functions enable a wide range of learning outcomes. These outcomes will be discussed in terms of the matrix of cognitive outcomes in Figure 1. This presents a taxonomy of six cognitive processes, each of which can be applied to four knowledge dimensions. For example, a learning outcome can be of type 4/C, *Analyse some Procedural knowledge*; a specific example of this, in the topic of metalwork, could be, *differentiate between welding and soldering*. Hence the taxonomy has a total of 4 x 6 = 24 types of learning outcome.

		Knowledge dimensions			
		A. Facts	B. Concepts	C. Procedures	D. Metacognitions
Cognitive processes	1. Remember				
	2. Understand				
	3. Apply				
	4. Analyze				
	5. Evaluate				
	6. Create				

**Figure 1. Anderson and Krathwohl (Eds) et al (2001) revision of Bloom’s taxonomy**

In Figure 2, a **bold red** font has been used for those categories of cognitive learning outcomes that can be achieved with non-stop viewing of self-standing video (no supplementary print), it being understood that the video has been diligently designed for effective learning. In which case, viewers can be enabled to **remember** and **understand** all four knowledge dimensions: **facts**, **concepts**, **procedures** and **metacognitions** (e.g. learning strategies, self-knowledge).

		Knowledge dimensions ( <b>overviews</b> rather than fine detail)			
		A. <b>Facts</b>	B. <b>Concepts</b>	C. <b>Procedures</b>	D. <b>Metacognitions</b>
Cognitive processes	1. <b>Remember</b>				
	2. <b>Understand</b>				
	3. Apply				
	4. Analyze				
	5. Evaluate				
	6. Create				

**Figure 2. Learning outcomes achievable with non-stop video viewing**

The categories in Figure 2 that are not highlighted indicate the kind of learning that cannot easily be achieved through non-stop viewing of video. That is, non-stop video is not an appropriate means of achieving the four highest level cognitive processes, *apply, analyse, evaluate, create* (although all of these are possible to some extent, especially *applying*). Moreover, even for the learning outcomes that are more easily achieved, non-stop video is more suitable for providing *overviews* of the four knowledge dimensions rather than fine detail.

Note however that *remembering* and *understanding* an *overview* of a knowledge topic is a useful (and sometimes even an essential) precursor of higher level processing of details. The reverse can also be true – an overview can provide a useful *consolidation* after a learner has undertaken concentrated study of detailed material, but has been left with a fragile grasp of the big picture.

Whether or not an overview is better studied before or after studying details depends on the learning task and the individual learner.

### **A crucial caveat**

For video, and indeed for all media, we assume that production resources and staff expertise are adequate to get the best out of each medium. However the judgement of adequacy varies between different institutions. For example, a UK OU TV producer's yearly load was between 6 and 8 half hour programmes. Koumi and Hung (1995) point out that this compares with more than 12 at the Indira Gandhi National OU in India and the Sukhotai Thammathirat OU in Thailand, more than 80 at the Chinese Radio and TV University and about 100 at Taiwan's Open University.

Assuming that we do have the resources to get the best out of each medium, there are many circumstances and learning tasks in which media other than TV excel, as follows.

### **Print**

Despite the wide variety of teaching functions for which TV and video is used (above), the UK OU believed that print is adequate for most OU study (as did most Distance Teaching institutions). Learning tasks for which print is probably more suitable than other media are

- for the presentation of precise, factually accurate information (Bates and Poole, 2003, p 175)
- when students need to study information in quantity, e.g. glossary, study guide (which is a crucial function for print)
- concentrated study at an individual pace for analysing fine detail, e.g. equations, diagrams, complex concepts, closely reasoned argument – and further when students are required to evaluate such material.

In contrast, as noted earlier, non-stop video is more suitable for providing overviews rather than fine detail and for enabling lower level cognitive processes such as *remembering, understanding* (and, to some extent, *applying*).

- where the student benefits from random access in order to skim and select (for example when students revise for an exam they sometimes need to search their printed booklets for scattered information on a particular point)

Occasionally, a learning task that appears at first sight to need video is better presented in print. For example, a series of stills (photographs) in text can substitute for a video animation. And sometimes this is more effective – when the changes at each stage are complicated and need individually paced contemplation, thus encouraging students to visualise the *in-between* images for themselves.

Returning to the cognitive taxonomy, Figure 1, what learning tasks can the print medium enable students to achieve?

### **An invitation to reflect on learning outcomes that the print medium can enable**

Firstly, the four knowledge dimensions, A, B, C, D – can all four be achieved? Think about this before reading on.

#### *My View*

It's difficult to generalise, but my feeling is that print may not be as good as video for dimension B, *abstract concepts* (see Table 1, item 1.4) and dimension C, *procedures (skills)* (see Table 1, domain 3) – summarised in Figure 3.

		Knowledge dimensions			
		A. Facts	B. <b>Concepts</b>	C. <b>Procedures</b>	D. Metacognitions
Cognitive processes	1. Remember				
	2. Understand				
	3. Apply				
	4. Analyze				
	5. Evaluate				
	6. Create				

**Figure 3. Learning outcomes better achievable through video than through print**

Now for Cognitive Processes: can print do better than video or worse? Again, think about this before reading on.

*My View*

3. *Apply knowledge*: better achieved through print for facts and metacognitions, due to reflection-time. Same for 4. *Analyse* and 5. *Evaluate*. In fact, the availability of reflection time also enables better achievement of 1. *Remember* and 2. *Understand* – for facts and metacognitions, as summarised in Figure 4.

		Knowledge dimensions			
		A. <b>Facts</b>	B. Concepts	C. Procedures	D. <b>Metacognitions</b>
Cognitive processes	1. <b>Remember</b>				
	2. <b>Understand</b>				
	3. <b>Apply</b>				
	4. <b>Analyse</b>				
	5. <b>Evaluate</b>				
	6. Create				

**Figure 4. Learning outcomes better achievable through print than through video**

What about 6. *Create*?

*My View*

The ability to create may be severely limited by the fact that print is a one-way medium (and so is video, as envisaged in this paper) – summarised in Figure 5.

The potential to achieve creativity through interactive, dialogic teaching and learning is examined later in this paper.

		Knowledge dimensions			
		A. Facts	B. Concepts	C. Procedures	D. Metacognitions
Cognitive processes	1. Remember				
	2. Understand				
	3. Apply				
	4. Analyze				
	5. Evaluate				
	6. <b>Create (↓)</b>				

**Figure 5. Learning outcomes difficult to achieve with one-way media**

**Recorded Video (usually with supplementary notes), designed to be viewed in short segments**

The contrast was made above between the suitability of print for concentrated study and of TV for providing overviews and lower level processing of knowledge. There are also learning tasks that are intermediate between *concentrated study* and *overview*, for example

*tasks that need concentrated study but flexible access to dynamic visual material*

Materials requiring such tasks were distributed by the UK OU on video cassettes, or broadcast in the early hours for students to record, with supplementary notes that were distributed in advance.

These videos are not intended to be viewed non-stop – they are deliberately designed to exploit the stop-start facility of the video player, incorporating student-activities during the stops. To this end, the videos include captions every few minutes that ask the viewer to stop the tape and carry out an activity described in the supplementary notes. For example, the caption could read

*2<sup>nd</sup> Video Stop. Carry out the activities in section 2 of your Video Notes.*

**Of course nowadays, the notes could be viewed online, as well as the videos.**

The videos are indexed, for example with scrolling numbers in top right of screen showing the video's duration in minutes and seconds. This allows the Video Notes to reference specific segments of the video. For example the notes in section 2 might read:

### Section 2. Laboratory techniques in segment 2 of the video (video index 05.05 – 11.40)

- Activity A for Tape Stop 2. Penicillin is a microbial (fungal) product that inhibits the growth of some bacteria. However, penicillin does not affect fully mature bacterial cells. Bearing this in mind, recall the film report of Fleming's discovery (video index 07.05- 08.47) and critique what Fleming claimed he had observed.
- Activity B for Tape Stop 2. At the beginning of the video segment, Dr Dring inserted the necks of tubes into a flame before transferring material from one to the other. He said he wanted to prevent contamination. Can you think of TWO ways in which this procedure prevents contamination?
- .....

An Appendix in the video notes would include "model answers" for these activities. (Incidentally, the answer for Activity A suggests that the discovery of penicillin's effect was the result of a misinterpretation by Fleming, following a careless procedure!)

The proportion of UK OU video that was designed in this form had been increasing steadily, reaching 30% by 1994, and still rising in 2000. (After about 2002, the Open University moved largely away from long-form narrative video to using short clips, termed *video assets*, inside digital multimedia packages).

The teaching functions of video are as in Table 1, but greater detail can be tackled with recorded video plus notes than with video designed to be viewed non-stop. Crooks and Kirkwood (1998) point to three areas for which recorded video is more effective than broadcast television, resulting from the facility to search, pause, stop, rewind and replay:

1. *providing vicarious experiences (that can be reviewed several times)*
2. *imparting visually or conceptually dense information*
3. *triggering reflection or group discussion*

Whereas all three areas are valid, there is a problem for area 2. In truth, the visual and conceptual density could not be increased very much, because video is a time-based medium, and this fact restricts the visual density and pace that viewers can comfortably process, even when the video segments are short and repeatable.

The average duration of each UK OU video was 30 minutes but students have to spend about 2½ hours studying the video as guided by its *notes*. Broadcast TV programmes (intended to be viewed once, without stopping) also had *Broadcast Notes* but these typically added only 20 to 30 minutes to the 25-minute viewing time.

#### *A second version of the print-video package*

There are two distinct versions of the above print-video package. One is *video-led*, in which the video does most of the teaching but where the supplementary print enables additional reflection and practice by the learner. This is the type illustrated above.

An alternative is a *print-led* package, where all the study guidance is in print, relating to successive short segments of the video recording. For example, a teacher-training package might be in this style, with the video-clips being pure *actuality* (recording of actual, unrehearsed behaviour, such as video observation of classroom activity), without commentary on the sound-track. The printed material would contain pedagogic rationale for the classroom methodology and would suggest reflective activities (e.g. through peer discussion) related to the observational video. For example:

1. Continue viewing the video from index 10:56 until 13:59. **There is a caption at this point that tells you to stop and carry out the activities in this section (write your comments below each question):**
  - a. The teacher divided the mixed ability group of 4 pupils into two pairs of 2 each. If this is done randomly, one of the pairs might have both pupils of high ability and the other pair might have both pupils of low ability. Is this appropriate for the tasks that the teacher assigned, or should she ensure that each pair is mixed ability?
  - b. At index 12:05, a girl is seen misbehaving near the teacher. The teacher ignores her; was this appropriate in this situation?

**Learning outcomes for the above three types of video, self-standing, video-led, print-led**

Having introduced three types of video, all with supplementary Notes, we could think of each type as a *hybrid* medium or a *composite* medium. Hence the augmentation of learning that is afforded by the supplementary print has to be taken into account. With this in mind, let's return to the question of learning outcomes that can be achieved with the three types. First, a summary of the three types.

*Summary of the three types of video package with supplementary print*

**1. SELF-STANDING VIDEO (non-stop viewing, as in viewing a TV broadcast):**

A video that does all the teaching by itself (a type sometimes referred to as *long-form narrative*), without the support of printed material. However, if desired, some video Notes could prepare students for the video and summarise it. And, most valuably: the Notes could suggest post-viewing self-test questions.

**2. VIDEO-LED print-video package:**

A package consisting of a *scripted* video plus printed Video Notes. All the teaching is done on the video by the commentary (with a few points elaborated in the Notes).

The video is in sections, designed to exploit the stop-start facility of the video player. Between sections, viewers stop the video and answer the questions in the Video Notes. The Notes supply answers, which may sometimes elaborate, giving extra information that is not contained in the video.

**3. PRINT-LED print-video package:**

Again, the video is in sections with interspersed questions. However, instead of scripted scenes, the video contains *actuality* (actual behaviour), such as the interactions between a schoolteacher and students.

There is no commentary on the video. All discussion of the contents of the video is carried out in the printed Study Guide, through question and answer.

Figure 6 summarises the features of the three types of video package ✓ ✗.

	1. SELF-STANDING VIDEO	2. VIDEO LED PRINT-VIDEO PACKAGE	3. PRINT LED PRINT-VIDEO PACKAGE
Commentary on video	✓ all teaching done on video	✓	✗
Video in sections, to be stopped and started	✗	✓	✓
Print suggests pre-video and post-video activities	✓	✓	✓
Print suggests activities related to the video content	✗	✓	✓
Print contains all the analysis of the video content	✗	✗	✓

**Figure 6. Checklist for the three types of video package**

*Learning outcomes achievable through the three types of video package*

Now that we have an idea what outcomes are achievable with the print medium, let's return to Figure 1 and consider how far the supplementary print has extended the possible learning outcomes of our three types of video.

For the first type, non-stop viewing of self-standing video, the supplementary notes could include post-viewing self-test questions, which could augment the range of teaching functions to include the third and fourth cognitive processing levels of Figure 1, *Apply* and *Analyse*. However, the *knowledge* would still involve no fine detail. This is because it is difficult for learners to reflect on the knowledge since all of it would come from the non-stop, time-based video medium, not the print medium. (The notes can't easily add detail because they refer to a large amount of video content, e.g. ½ hour).

The additional learning outcomes are summarised in Figure 7.

		Knowledge dimensions (still overview rather than fine detail)			
		A. <b>Facts</b>	B. <b>Concepts</b>	C. <b>Procedures</b>	D. <b>Metacognitions</b>
Cognitive processes	1. <b>Remember</b>				
	2. <b>Understand</b>				
	+ 3. <b>Apply</b>				
	+ 4. <b>Analyze</b>				
	5. Evaluate				
	6. Create				

**Figure 7. Extra learning outcomes afforded by post-viewing exercises in the Broadcast Notes** (in addition to cognitive outcomes 1 and 2 through the video alone)

In the second type (Video-led), due to the fact that only **short** video segments are viewed, the **depth** of knowledge can be somewhat greater – finer detail and conceptually more dense. That's **without** the supplementary print. Now take that into account – the questions and answers in the print can extend the learning outcomes to the fifth cognitive process – *Evaluate* – as summarised in Figure 8.

		Knowledge dimensions (in finer detail)			
		A. <b>Facts</b>	B. <b>Concepts</b>	C. <b>Procedures</b>	D. <b>Metacognitions</b>
Cognitive processes	1. <b>Remember</b>				
	2. <b>Understand</b>				
	3. <b>Apply</b>				
	4. <b>Analyze</b>				
	+ 5. <b>Evaluate</b>				
	6. Create				

**Figure 8. Extra learning outcomes afforded by the short video segments plus the questions and answers in the Video Notes** (in addition to the cognitive outcomes through non-stop video plus Broadcast Notes – Figure 7)

For the third type (print-led) the video is observational, without commentary. So the teaching functions are a combination of the Print affordances in Figure 4 and the **experiential** function in box 2 of Table 1. Also the **skills** function box 3.

The conceptual density may not be as great as type 2 (video-led), because of the absence of simultaneous commentary to analyse what the video is showing. On the other hand, because learners concentrate on observing **behaviour**, they may achieve the basics of the final cognitive process, Create (in the sense of creating a classroom skill)– summarised in Figure 9.

		Knowledge dimensions (not as fine detail as Video-led – Fig 8)			
		A. <b>Facts</b>	B. <b>Concepts</b>	C. <b>Procedures</b>	D. <b>Metacognitions</b>
Cognitive processes	1. <b>Remember</b>				
	2. <b>Understand</b>				
	3. <b>Apply</b>				
	4. <b>Analyze</b>				
	5. <b>Evaluate</b>				
	+ 6. <b>Create (skills)?</b>				

**Figure 9. Extra learning outcome afforded by observing unscripted behaviour**

### Caveat 1

Don't be too ambitious. Cognitive processes 4, 5, 6 (analyse, evaluate, create) are very difficult to achieve with a one-way medium. For example, videos demonstrating classroom teaching methodology, even when supplemented with **printed study guidance** and **discussion** (as in the Type 3, print-led video example above) also need supplementing with **teaching practice** and **formative evaluation** (through dialogue with a teacher who can **adapt** to the individual learner).

### Caveat 2.

It has been claimed that video can achieve the 24 techniques and teaching functions in Table 1 distinctively well – and that these can result in a wide range of learning outcomes, especially when

complemented appropriately with printed materials. But video will fail to achieve this potential if it is designed badly. It has to be designed so that it is pedagogically effective. Table 2 summarises the design principles that are discussed in detail in Koumi (2006).

**Table 2. Pedagogic screenwriting structure for each section of the content**

<p><b>1. HOOK</b></p> <ul style="list-style-type: none"> <li>a Shock / surprise / delight</li> <li>b Fascinate, entertain/amuse, appetise, create suspense</li> </ul>	<p><b>5. SENSITISE</b></p> <ul style="list-style-type: none"> <li>a Seeding</li> <li>b Consistent style</li> <li>c Reassure / build confidence</li> </ul>
<p><b>2. SIGNPOST</b></p> <ul style="list-style-type: none"> <li>a Set the scene / Introduce</li> <li>b Signpost: what's coming later</li> <li>c Chapter Heading: what's next?</li> <li>d Rationale: why we are doing it</li> </ul>	<p><b>6. ELUCIDATE</b></p> <ul style="list-style-type: none"> <li>a Vary tempo to indicate syntax</li> <li>b Restrain picture-word density</li> <li>c. Maximise Cognitive Clarity</li> </ul>
<p><b>1. FACILITATE ATTENTIVE VIEWING</b></p> <ul style="list-style-type: none"> <li>a Pose questions</li> <li>b Encourage prediction</li> </ul>	<p><b>7. REINFORCE</b></p> <ul style="list-style-type: none"> <li>a Repetition (with a different angle)</li> <li>b Re-exemplify</li> <li>c Compare / Contrast</li> <li>d Synergy between words and pictures</li> </ul>
<p><b>2. ENABLE CONSTRUCTIVE LEARNING</b></p> <ul style="list-style-type: none"> <li>a Words NOT DUPLICATING pictures</li> <li>b Pause commentary for contemplation</li> <li>c Invent visual metaphors</li> <li>d Scaffold the construction of knowledge</li> </ul>	<p><b>8. CONSOLIDATE/ CONCLUDE</b></p> <ul style="list-style-type: none"> <li>a Consolidate / Summarise key features</li> <li>b Chapter Ending</li> </ul>

**REFERENCES**

Anderson, L.W. (ed), Krathwohl, D.R. (ed), Airasian, P.W., Cruikshank, K.A., Mayer, R.E., Pintrich, P.R., Raths, J. and Wittrock, M.C. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's Taxonomy of Educational Objectives*, New York: Longman.

Bates A W and Poole G (2003), *Effective Teaching with Technology in Higher Education*, Jossey-Bass

Crooks B and Kirkwood A (1988) *Video-cassettes by design in Open University courses*, Open Learning Vol 3, No 3

Koumi J and Hung P (1995) *Video production in UK and Taiwan OU's*, Proceedings of the AAOU Conference in Taipei

Koumi J (2006), *Designing video and multimedia for open and flexible learning*, RoutledgeFalmer