**Potent Pedagogic Roles for Video**

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**Abstract.** The paper considers techniques and teaching functions for which video is outstandingly capable – in four domains: Cognitive, Experiential, Affective, Skills. The learning goals thereby afforded are characterised in terms of the Revision of Bloom’s Taxonomy of Learning Objectives.

**Introduction**

Figure 1 lists 34 categories of pedagogic roles for video. It will be argued that each of these can add substantial value to instructional multimedia.

The pedagogic roles comprise video techniques and teaching functions that exploit video’s distinctive presentational attributes and that other media cannot achieve as effectively – not even a face-face teacher in most cases. The roles are categorised into four domains.

1. Facilitating COGNITION
2. Providing realistic EXPERIENCES
3. Nurturing AFFECTIVE characteristics (motivations, feelings)
4. Demonstrating SKILLS

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| **1. Facilitating COGNITION [[1]](#footnote-1)** |  | **2. Providing realistic/amplified EXPERIENCESby showing otherwise inaccessible:-** |
| 1 **composite images,** e.g. split screen, superimposition2 **animated diagrams** exploring processes3 **visual** **metaphor/analogy/representation**4 **illustrating** concepts with real examples5 **modelling** a process by judicious simplification6 **juxtaposition** of contrasting situations7 **simulating** variable features8 **condensing time** by editing real life9 **narrative power** through synchronous narration and pedagogic design |  | 1 **movement** with synchronous location sound2 **viewpoints** e.g. aerial, undersea, microscopic, extreme close-up3 **places** e.g. dangerous/overseas locations4 **3D**, by good lighting & moving object or camera5 **slow/fast** motion6 **people/animals** interacting, real or drama7 **chronological** sequence and pacing8 **resource material** for viewers to analyse9 **one-off or rare events,** including archive film10 **staged events** e.g. dramatised enactments, complex experiments |

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|  | **3.** **Nurturing AFFECTIVE characteristics** |  | **4. Demonstrating SKILLS [[2]](#footnote-2)**  |
| attitudesemotionsengagingactivationresolve motivation | 1 **galvanize / spur into action**, provoke viewers to get up and do things2 **motivate a strategy** by showing its success3 **stimulate** appetite to learn, e.g. reveal the fascination of the subject4 **change** **attitudes/appreciations**, e.g. engender empathy5 **alleviate isolation** **of the distant learner**by showing/hearing the teacher or peers6 **reassure, encourage self-efficacy**7 **authenticate academic abstractions** by showing them solving real-life problems8 **create sense of importance,** e.g. byusing famous presenters |  | 1. **manual/craft**: making learning aids, cookery, joinery, painting, designing
2. **body movement**: dance, fitness routines, athletics
3. **reasoning**: problem solving, planning, brainstorming
4. **interpersonal**: counselling, interviewing, teamwork, classroom teaching
5. **verbal**: language proficiency, singing, recitation, authoring
6. **studying**: researching information, exam strategy, collaborative learning
7. **technical**: laboratory, mechanics, nursing
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**Figure 1. Potent Pedagogic Roles for Video: techniques and teaching functions to facilitate learning**

**There are several pedagogic roles for each of the 34 items**

### Most items in Figure 1 have several versions and applications.

### This is explicitly noted for many items, since they include subdivisions. For example item 2.2 (viewpoints) lists four different viewpoints. Then again in Domain 4 (Demonstrating Skills) each of the seven items lists three or more different skills.

### There are also several items for which the many subdivisions are not listed explicitly. For example, the following variety of video clips all involve a *composite image* (item 1.1)

1. *fleshing out* skeletons in biology or archaeology with slowly superimposed graphics
2. *graphically superimposing* geological strata lines on a freeze of a cliff face – the lines would be absent to start with, then superimposed on then off, then again on and off
3. *split-screen* – e.g. a loaded beam on the left with a shot of the strain gauge on the right
4. *highlighting* parts of a picture while dimming other parts – to help discrimination
5. *chroma-key –* a presenter beside a screen onto which another video clip is keyed.

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| Subdivisions of further items are covered in a later section, *Amplified Realism*, and in Koumi (2006, Ch. 1-3) |

**The provenance of the techniques and teaching functions in Figure 1**

The claim that the 34 categories in Figure 1 add distinctive value to learning derives largely from expert teachers’ opinions rather than from empirical research. Their provenance is as follows.

About half the functions correspond to the “distinctive video-value list” drawn up in the 80’s by the UK Open University’s *Broadcast and Audio-Visual Subcommittee*, with the purpose of ensuring cost-effective use of video. This list comprised pedagogic roles that video could deliver outstandingly well compared to other available media. OU Course Teams had to make a compelling case that the learning outcomes they intended for video really did need video’s distinctive presentational attributes. And they had to supply convincing arguments that other, cheaper media would be less effective. Through the years, this procedure led to the compilation of 18 functions that were adjudged by consensus and research to exploit the distinctive strengths of video (Bates, 1984 – Appendix). These 18 have been expanded into the above 34 categories, mostly as a result of further deliberation during ten three-month courses on Educational TV for Development, run at the BBC Open University Production Centre between 1982 to 1994 (Koumi, 2006, pp. 3, 99). Workshops by this author have led to further refinements and to the categorisation into the four domains of Figure 1.

**Video’s presentational attributes**

The basis of the learning-facilitation claim for the techniques and teaching functions in Figure 1 is the rich *symbol system* of video – its presentational attributes, listed in Figure 2.

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| * moving images with synchronous narration and location sound
* real-time or slow motion
* real-life or diagrammatic
* real or dramatised behaviour (can include comparing styles of personal interaction)
* extreme close-ups
* chronological sequencing and pacing of sound and images (e.g. enabling the display of body language and the phrasing of speech)
* visual metaphor
* specially constructed physical models to represent objects or concepts
* camera moves, zooms and framing
* customised lighting to ‘sculpture’ objects (hence bring out their three-dimensionality)
* shot transitions (including editing to condense time)
* composite images, e.g. split-screen, superimposition (including key-word screen-text)
* varying format (e.g. a segment in studio, then on location, interspersed with animation)
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 **Figure 2. Video’s presentational attributes**

In most circumstances, in all of the 34 categories of Figure 1, the presentational attributes in Figure 2 make video more effective than other media.

There are exceptions, one of which occurs in the Affective domain. A well-scripted dramatized enactment on audio can sometimes evoke more realism and emotion than video – by stimulating the listener’s visual imagination. For instance, under category 3.4, *engender empathy*, audio can powerfully portray a case of child abuse to trainee social workers. (A child actor could not undertake such a role on video, whereas an adult could assume the role of the child’s voice in an audio drama).

This example has illustrated that for some functions in Figure 1, in certain circumstances, there is a better choice of medium than video. At the other extreme, there are some categories for which there is no alternative to video, because video can provide *amplified realism* – e.g. 2.5 (*fast motion via time-lapse recording)*, whereby real life can be speeded up thousands of times.

**The nature of the four domains: presentational attributes and teaching functions**

The above presentational attributes of video (listed in Figure 2) are the techniques that are shown distributed between the Cognitive and Experiential domains of Figure 1 (domains 1 and 2). The techniques in the Cognitive domain facilitate learning while those in the Experiential domain engender realism. Domains 3 and 4 both comprise teaching functions rather than techniques – affective functions in Domain 3 and skills functions in Domain 4.

These points are elaborated in subsequent sections, as are the relationships between domains.

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| **CAVEAT. Presentational Attributes need to be potentiated through Pedagogic Design**It has been claimed that video can achieve the 34 pedagogic roles in Figure 1 distinctively well due to its rich presentational attributes, resulting in learning facilitation. But to achieve this potential video needs to be designed for cognitive engagement and constructive reflection. A framework of pedagogic video design principles is summarised in Koumi (2013a); this is a downloadable paper with embedded video clips. |

**Learning through the video techniques and teaching functions in Figure 1**

A considerable number of studies have investigated the claim that video can facilitate learning through the techniques and teaching functions of the four domains of Figure 1.

**Learning through the video techniques of the Cognition Domain of Figure 1**

***Learning ANTICIPATED through the techniques of the Cognition Domain***

Provided a video has been well designed pedagogically, the learning outcomes of the techniques and teaching functions in the Cognition domain of Figure 1 are posited in Figure 4.

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| * 1. **composite-image techniques** can aid synthetic, analytic and discrimination skills; for substantiation of this claim see the various video clips illustrating these techniques, top of p.2
	2. **animated diagrams** – for explaining dynamic processes: they help students to share the teacher's imagery; particularly powerful is interspersing real life with animation of obscured motion, e.g. the motion of the diaphragm of a person with breathing difficulties
	3. **visual metaphor/analogy/representation** – to concretise abstract processes
	4. **illustrating** abstract concepts with evocative real-world examples, hence making the concepts more tangible. (Note the overlap with domain 2 - the presentation of real-world examples would entail experiential techniques, such as *staging events* or *visits to dangerous locations*. However, domain 2 is **what** we show, whereas 1.4 is a **why** we show it (a **teaching function)**
	5. **modelling** a process with a tailored, simplifiedversion– which scaffolds learning by showing only the pertinent features. (Like 1.4, this is another teaching function.)
	6. **juxtaposition** in quick succession, of contrasting situations/processes – to aid discrimination
	7. **simulating variable features** – thereby students can be given control of the parameters and chose which features to view and in which order
	8. **condensing time** by pruning real-world processes (e.g. editing out non-salient events) thus bringing the duration within the viewer's concentration span
	9. **narrative power** – narrative creates coherence and aids recall through its network of causal links and signposting (Laurillard et al, 2000). Additional respects in which narrative facilitates learning are discussed in Koumi (2006, Chapters 5 and 6).
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**Figure 4. Learning anticipated through the techniques in Domain 1 of Figure 1 (Cognition)**

***Evidence of learning through the techniques of the Cognition domain***

Figure 4 (anticipated learning), as well as Figure 1 (pedagogic roles for video), derives from experts’ opinions rather than empirical research. As for evidence, many studies have shown that video helps learning, summarised in Wisher and Curnow (2003), Saltrick, Honey and Pasnick (2004 – for specific topics, such as Science, History, Mathematics, Social Studies) and Paulsen and Bransfield (2010). This is despite the fact that the videos investigated were produced without the benefit of comprehensive design principles such as those in Koumi (2006 and 2013a).

**Learning through Domain 2 – provision of Realistic/Amplified Experiences**

***Facilitation of learning through depiction of real life experiences***

Apart from some abstract subjects like Logic and Pure Mathematics, learning in the Cognitive domain is largely concerned with knowledge about the real world, therefore when learners experience the real world (vicariously but realistically) their study is grounded in context. Jonassen (1991) argues that context provides ‘episodic memory cues that make the acquired knowledge more memorable’ (p. 37). McLellan (1994) pointed out that context in learning environments can be provided by an anchoring context such as a video or multimedia program.

Consequently, instructional video is often used to transport learners into the real world.[[3]](#footnote-3) A particular example is learning how lab techniques are scaled up in industry (Koumi, 2006, pp 90-91). Indeed, apart from *animation* and *visual metaphors,* all the roles in the Cognition domain, involve real life experiences.

The above arguments, which were focussed on cognitive learning, apply even more so to skills learning. Admittedly, many vicarious video experiences of skills demonstrations need to be followed up by real life practice, but the video depiction would provide valuable grounding.

The same is true for all the Affective roles – they all involve showing real life experiences and behaviour. For example, changing attitudes towards people might involve seeing various contrasts in situ, like peoples’ socialising behaviour (Bates, 1984, p. 246).

The strength of all these influences is mediated by how realistic are the vicarious experiences.[[4]](#footnote-4)

***An added bonus of the Experiential domain – Amplified Realism***

Beyond mere realism, items 2, 5 and 9 of the Experiential domain of Figure 1, *extreme close-ups*, *slow/fast motion*, and *staged events*, supply *amplified realism* that cannot be experienced in real life.

For example, an *extreme close-up* of a carpenter’s chisel preparing a depression for a mortice lock; this shot can be so tight that trainee carpenters could not experience the view in real life because they would need to stand too close for their eyes to focus.

Regarding *slow-fast motion* (item 5 of the Experiential domain), this could display

*slow motion of*

* a bird in flight; or predators hunting
* air-bags expanding in a car crash
* a vibrating string, showing an clear image of the shape of the string

*fast motion of*

* cloud movement; flowers growing; bacteria dividing
* a bird, nest-building; a spider, weaving its web
* the 12 hour tidal cycle speeded up 1500 times

Under item 9, *staged events*,

* a carefully controlled spray of water under special lighting conditions to demonstrate a rainbow that is in the form of a complete circle
* in a safety training video, staged accidents, made to look real by contrived editing tricks

**The extent to which video engenders Affective changes in students (Domain 3)**

To what extent can video affect motivations and emotions, and over what time frame?

Miller (2005) notes that social learning theorists suggest that observing a model via video is a viable method of learning a new attitude while affective-cognitive consistency theorists suggest that the affective component of the attitude system may be changed by first changing the cognitive component through providing new information, e.g. as in anti-smoking or literacy campaigns on TV.

Altinay, Brown and Piccoli (2012) report a more nuanced result in which the cognitive component did not correlate with attitude change. They found a significant change in attitude and intentions to act following the viewing of a video on Climate Change which was *personally framed* (framed in terms of the effect on the individual). A video *framed globally* and one *depicting facts only* did not reach significance on attitude change.

Zimbardo & Leippe (1991, p.154-58) report research findings on attitude change that a complex message is more persuasive when presented in writing “presumably because, it could be better comprehended if it was read”, while an easy-to-understand message was most persuasive when presented on video. Other findings were that experts and likeable presenters on video were much more persuasive than unlikeable non-experts and the effect was stronger for video than for print.

Other researchers (Azevedo, 2006; Renninger, Bachrach & Posey, 2008) note that sustained changes in students’ interest require multiple triggers rather than through video alone.

**Evidence of learning Skills through video demonstration (Domain 4)**

Typing *video demonstration of skills* into Google results in a billion entries, including many videos demonstrating skills, in every category of the Skills domain. But how effective are such videos?

There is a large body of research regarding the efficacy of Cognitive Apprenticeship (Collins, Brown and Holum (1991), Cash, Behrmann, Stadt and Daniels (1997).

Collins, Brown and Holum (ibid) characterise Cognitive Apprenticeship in terms of four main phases: modelling, coaching, scaffolding and fading. In modelling, the *Master* demonstrates the target task and exposes the thinking behind it. The master then coaches the apprentice who undertakes activities towards becoming an expert. These activities are designed to support or *scaffold* the learning. For example, the activities could be sub-tasks or simplified versions of the task. *Fading* refers to progressive withdrawal of the scaffolding as the learner becomes more proficient.

Video demonstration of skills covers the first phase, modelling. The other three phases are usually necessary to become an expert; however the efficacy of modelling alone, using video, has been exemplified in several studies, while being challenged in others.

*Nova Scotia Online Learning* have produced creditable videos in their Virtual Campus Apprenticeship programme, which has produced an average of 800 graduates per year between 2005 and 2011. Some of the videos, for coaches, encompass both manual skills and teaching skills.

Kemper, Foy, Wissow and Shore (2008) found that 59 of the 61 clinicians who viewed demonstration videos on communication skills judged that their skills had improved significantly.

Donkor (2000) showed, as expected, that Video was superior to Print materials in practical skills and craftsmanship of block-laying and concreting.

In contrast, a study carried out on 40 students of Nursing and Obstetrics by Mouneghi, Derakhshan, Valai and Mortazavi (2003), showed that live demonstration was superior to a video demonstration for the skills of *changing a wound dressing and washing the hands*. However, students grades were still high after video demonstration, so the authors concluded that video can be a suitable substitute whenever live demonstration was difficult to manage.

All four studies above show that video can be effective in the learning of skills, although the fourth showed that live demonstration was superior to video.

**Caveat: a fundamental problem with media comparison studies**

Care should be exercised in interpreting the third and fourth studies above. There are many media comparison studies such as these, but they all suffer from a fundamental problem: how well were the different media designed? Neither of the above studies gave a description of the video design.

Donkor’s video was based on existing print materials, but the designers would have attempted to design as good a video as possible, so possibly some pedagogical enhancements were incorporated into the video, making the design of the video pedagogically superior to that of the print materials.

Conversely, the pedagogic potential of video may have been under-achieved (which would strengthen Donkor’s results). For example, if the video treatment was based strictly on the print treatment (in the attempt to compare like with like), the full potential of video would have been under-achieved. This is because each medium has its own distinctive presentational attributes that need to be fully exploited by choosing distinctive treatments of the topic. For example, in the topic of mixing cement, the print material would probably start with the beginning of the procedure, whereas the video had better start at the end, showing the desired consistency of the final mix before jumping back to the start of the mixing. So rather than comparing like with like, Donkor’s study was actually comparing (bad) apples with oranges.

Similar issues concern the study by Mouneghi et al (2003). In a video recording of a manual skill, special lighting is needed to bring out the three-dimensionality. The demonstrator’s movements also need care so as not to obscure the camera’s view. Other techniques, like cutting to an extreme close-up at critical points, could serve to make the video experience *more* informative than the live demonstration. Also more informative would be to position the camera so that viewers get a virtual experience of personally performing the skill – i.e. place the camera close to the eye-line of the demonstrator. In a live demonstration this viewpoint would need all trainees to stand just behind the demonstrator’s ear – not possible. Moreover, to achieve optimum video treatment, the demonstrator’s narration needs to accommodate the special shooting techniques. It is unlikely that such skills were used by the researchers, since they did not mention video design issues.

Such considerations point to critical flaws in media comparison studies. In order to be fair to each medium, we would need to employ creative practitioners and allow them adequate resources and thinking-time to exploit the full potential of each medium's presentational capabilities. This means not only good design[[5]](#footnote-5) but the concept of *comparing like with like* has to be abandoned in favour of judging which *different treatments* of the topic best exploit the affordances of the different media.

These methodological problems apply just as well in the Cognitive and Affective domains.

**Taxonomy of Learning Outcomes achievable through video**

The presentational attributes of video enable the array of techniques and teaching functions in the Cognitive domain of Figure 1. These suggest a wide range of cognitive learning outcomes that can be afforded by video, as expounded in Figure 4 and supported in general terms by the research literature. It has been argued that such learning outcomes (plus the potential for further outcomes) can be helped by the realism engendered by the Experiential domain of Figure 1. More crucially, all the presentational attributes need to be potentiated by effective pedagogic design, as in Koumi (2013a).

These outcomes will now be discussed in more specific terms through the two-dimensional matrix of cognitive learning goals in Figure 5, with a shaded cell as an example of how to interpret the matrix of learning outcomes. This cell indicates a learning outcome 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.

The Taxonomy deals largely with the Cognitive domain, but not exclusively. Firstly, the cell Create/Procedures in Figure 5 does include *production of skills* in the expanded version of the taxonomy (Krathwohl, 2002) [[6]](#footnote-6). Secondly, the expanded version of ‘Metacognitions’ includes ‘self-knowledge’ and this encompasses most of the affective teaching functions in Figure 1.

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|  | Knowledge dimension |
| A. Facts | B. Concepts | C. Procedures | D. Metacognitions |
| Cognitive Processes | 1. Remember |  |  |  |  |
| 2. Understand |  |  |  |  |
| 3.Apply |  |  |  |  |
| 4. Analyse |  |  |  |  |
| 5. Evaluate |  |  |  |  |
| 6. Create |  |  |  |  |

**Figure 5. A typical cell, 4/c, in the Revision of Bloom’s taxonomy of Learning Objectives (Krathwohl, 2002)**

In Figure 6, a **bold** font has been used for those 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 (Koumi, 2006 and 2013a). In which case, viewers can be enabled to *remember* and *understand* all four knowledge categories: *facts, concepts, procedures* and *metacognitions,* for the following reason.

The types learning in Figure 4 clearly cover *1 Remember* and *2 Understand* for knowledge categories *A Facts, B Concept, C procedures*. The arguments above regarding skills also indicate that *3 Apply* can also be achieved (to an extent, hence only pale shading).

As for*D Metacognitions*,in the expanded taxonomy, this has subcategories*, learning strategies (both general and task-specific)* and *self-knowledge*. Thefirst subcategory, *learning strategies***,** can be targeted by *1.5* of Figure 1, *modelling a process.* The second, *self-knowledge*, can be touched on by *1.3 metaphor*(e.g. metaphor for fear of change). And as noted earlier, most of the Affective teaching functions in domain 3 of Figure 1 directly facilitate self-knowledge.

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|  | Knowledge dimension (**overviews** rather than fine detail) |
| A. **Facts** | B. **Concepts** | C. **Procedures** | D. **Metacognitions** |
| Cognitive processes | 1. **Remember** |  |  |  |  |
| 2. **Understand** |  |  |  |  |
| 3.Apply |  |  |  |  |
| 4. Analyze |  |  |  |  |
| 5. Evaluate |  |  |  |  |
| 6. Create |  |  |  |  |

**Figure 6. Learning outcomes achievable with non-stop video viewing**

The categories in Figure 6 that are not highlighted indicate the kind of learning that cannot easily be achieved through non-stop viewing of video (as contrasted with viewing short segments, interspersed with formative quizzes). That is, non-stop video is not an appropriate means of achieving the three highest level cognitive processes, *analyse, evaluate, create*. Moreover, even for the learning outcomes that are more easily achieved, non-stop video is more suitable for providing *overviews* of the four knowledge categories rather than fine detail (hence the bracket in the top line of Figure 6).

Note however that *remembering* and *understanding* an *overview* of a knowledge topic is a useful (and often 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.

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| A paper to be published soon, ***Learning Outcomes afforded by self-assessed segmented Video-Print combinations***, describes how the learning outcomes can be considerably augmented when videos are segmented, complemented with printed materials and self-assessed. |

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1. The types of learning anticipated through each item of Domain 1 (Cognition) are examined later (in Figure 4) [↑](#footnote-ref-1)
2. Demonstrations take the form of a tutorial if the demonstrators talk through the thinking behind their skill [↑](#footnote-ref-2)
3. Laurillard (1993) regards such *vicarious experiences* (e.g. viewpoints, places, staged events) as being a “logistical delivery roles for video, whereas given enough resources, the students would engage in these experiences directly” (p.114). However, logistic delivery can be indispensable. There will never be enough resources (or permissions) to take every cohort of students to far-flung or dangerous locations and supply them with powerful telescopes, helicopters, or bathyspheres. [↑](#footnote-ref-3)
4. Regarding realism, an influence that may not be immediately obvious are the *sounds* of the location – the type of sound track that is recommended in item 1 of Domain 2. To capture the realism of the recorded event, the *location sound* should be recorded synchronously (the actual sounds made by objects and people, usually called *sync sound*). The realism of the events is severely reduced if no sound is recorded**,** which is often the practice of less professional video recordists. [↑](#footnote-ref-4)
5. See Koumi (2013b) (also in Academia.edu) for a recent project in which video demonstrated language skills (function 4.5 of Figure 1), and in which the 56 videos closely adhered to the design principles in Koumi (2006). [↑](#footnote-ref-5)
6. In the expanded version, there are several subcategories of Cognitive processes and of Knowledge dimensions. [↑](#footnote-ref-6)