



**Interactive training with dvd-video: the revival of self-contained instructional media**

Journal:	<i>British Journal of Educational Technology</i>
Manuscript ID:	draft
Manuscript Type:	Original Manuscript
Date Submitted by the Author:	n/a
Complete List of Authors:	Westera, Wim Hoogveld, Bert van der Vegt, Wim
Keywords:	Multimedia, DVD, Interactivity, Instruction

powered by ScholarOne  
Manuscript Central™

## *Interactive training with dvd-video: the revival of self-contained instructional media*

**Wim Westera, Bert Hoogveld and Wim van der Vegt**

*Address for correspondence: Wim Westera, Educational Technology Expertise Centre, Open University of the Netherlands, NL-PO Box 2960, 6401 DL Heerlen, The Netherlands; tel: ++ 31 45 5762408; email: Wim.westera@ou.nl*

### **Abstract**

Dvd-video provides an effective means for the implementation of interactive training programs. Boosted by the efforts of the motion-picture industry, dvd-video has been widely accepted in the consumer electronics market. The dvd-video standard supports high quality audio and video (mpeg2) as well as menu-driven navigation. Its educational potential lies in the complex interactive structures, which can be built by combining menus, and the selective presentation of texts, sounds and images. This paper explains the educational use of dvd-video, while referring to successful dvd-video programs that have been developed for the academic degree programme on psychology of the Open University of the Netherlands. It describes the design of complex interactive scenarios, which may include sequences with fading support, multiple choice questions, performance dependent feedback or gradually increasing complexity. It treats the pros and cons of dvd-video as compared to computer courseware and web applications. Although dvd-video is a stand-alone medium and thus lacks any network communication, it convincingly beats the alternatives on other aspects: wide availability and acceptance, easy production, easy operation, high reliability and low cost.

*Keywords: , multimedia, dvd, interactivity, instruction*

### **Introduction**

While current trends in educational technology focus on online learning, computer conferencing, virtual communities and other networked arrangements, it is hazardous to exhibit dvd-video as a promising alternative. Indeed, dvd-video lacks many features of current electronic learning environments that are linked up with institutional learning management systems, collaborative workspaces and online support. Against this background promoting the dvd-video in education seems a pitiful regression to stand-alone carriers of information, like the book, the video cassette or the cd-rom, who are becoming more and more obsolete. As will be shown in this paper, however, dvd-video has a number of interesting features that suggest its profitable educational use. By now, the motion-picture industry has amplified the acceptance of dvd-video as a world standard, by providing a continuous flow of movie releases on dvd-video to replace the VHS-video cassette. This has caused a stunning growth of dvd-video players sales. Penetration rose from 16 % of the households in 2001 to 60% in 2005 (Spot, 2006). Such figures are far more encouraging than those achieved in the ninety's by the compact disc interactive (cd-i). The cd-i can be considered the precursor of the dvd-video, because it also offered promising interactive features, it also defined a world standard

1  
2  
3 and it also was linked with the tv-set rather than the computer (Hoffos, 1992). However, the  
4 cd-i left the scene because of lacking entertainment content and short-falling penetration. In  
5 the case of dvd-video, however, the wide availability and acceptance would be a good  
6 starting point for its application in education.  
7  
8

9  
10 In this paper we will explore the educational potential of dvd-video. We will first describe the  
11 main characteristics of dvd-video. Next we will explain how dvd-video can be designed and  
12 used as in interactive medium in education and training. Occasionally, we will refer to dvd-  
13 video programs that have been developed by the Open University of the Netherlands. In  
14 addition, we will identify strengths and weaknesses of dvd-video and compare dvd-video with  
15 stand-alone computer courseware (e.g. dvd-rom or cd-rom) and web applications.  
16

### 17 **Explaining dvd-video**

18 The abbreviation “dvd” stands for “digital versatile disc”. With the naked eye a dvd can  
19 hardly be distinguished from a cd-rom or a cd-audio. It uses the same optical storage  
20 technology of laser-burnt pits on a reflecting surface. But by using different laser colours and  
21 higher pit densities the data capacity of a dvd may rise to 9 Gb or even higher, which is far  
22 more than a cd-rom (0.8 Gb). This large capacity makes dvd quite suitable for the distribution  
23 of high-resolution feature films (up to 4 hours of mpeg2 video format). It should be noted,  
24 however, that a dvd-video differs significantly from dvd-rom, which only offers large storage  
25 capacity. A dvd-video is created by writing on a dvd according to the technical dvd-video  
26 application format. This standard allows a number of user functions, that become available by  
27 playing the dvd in a dvd-video player, which is connected to a tv-set, or a tv-monitor. One  
28 salient feature of the dvd-video standard is the possibility of defining user menus, which  
29 allows user to choose their video clips or graphics, to change settings or to select a different  
30 menu. Users make their choices by using the apparatus’ remote control. So, in contrast with  
31 dvd-roms and cd-roms, the dvd-video is designed to be used in conjunction with the tv-set,  
32 not the computer. This matches the needs of the movies industry to provide the whole family  
33 with home entertainment in the living room.  
34  
35  
36  
37  
38

39 Below, we will outline the characteristics of dvd-video (Taylor, 2000).

#### 40 *Digital storage capacity*

41 Because of the large capacity of 9 Gb or more dvd is suitable for the storage and distribution  
42 of large amounts of data, as is the case for sound, graphics and video.  
43  
44

#### 45 *High-resolution image*

46 The dvd-video standard uses the mpeg2 video format, which features a resolution of 720x576  
47 pixels (PAL-format); this is much better than the VHS video cassette and the mpeg1 video  
48 format (352x288 pixels), which is common on the PC. Also the bit rate is much higher, which  
49 ensures stable video display without bumps.  
50  
51  
52

#### 53 *High quality sound*

54 Dvd-video offers high quality sound in mono, stereo or home cinema surround.  
55

#### 56 *Parallel sound tracks*

57 Dvd-video offers 8 sound tracks. This enables multilingual voice-over versions as well as  
58 various levels of spoken explanation.  
59  
60

### *Subtitling*

Dvd-video features 32 subtitling tracks. These can be used for multilingual versions, for subtitling in support of deaf persons or for additional information in running video streams. For example, a video for an observational assignment might be extended with textual hints or pointers to guide the different target groups (“...look at his left hand...”). Because the subtitling channels are graphical in kind, also graphic overlays (arrows, circles, etc) may be used.

### *Menu structure*

Most dvd-videos use chapter menus to allow the user to jump to the various sections of the movie. Menus, however, can be combined (serial, parallel or mixed) in order to create complex interaction structures.

### *Multi angle*

Dvd-video offers up to 9 synchronised camera angles. Provided that an event is shot from multiple angles users can select their favourite angles. In education one might apply multiple angles in observational exercises.

## **Educational potential of dvd-video**

The pedagogical significance of interactive multimedia programs has been substantiated extensively elsewhere (among others Kulik, 1994) and will not be treated here. Basically, solutions to instructional problems can be found by designing learning tasks that presuppose the flexible treatment of audio, video, texts and graphics, flexible routes largely under the control of the learners and various levels of support and feedback. Dvd-video might be a good candidate here, but naturally several possible solutions have to be compared. Thorough competition will be offered by computer courseware and web-based applications, as these are likewise capable of representing interactive learning scenarios. So far, the Open University of the Netherlands has successfully developed various dvd-video training programs for its academic degree programme on psychology (Van der Vegt, Westera, Hoogveld and Puls, 2005). First, the program “Social Psychology, Attitudinal and behavioural change” (Hoogveld, Bos and Van der Vegt, 2002) covers the implications of using a methodical intervention cycle for aids prevention in secondary schools. The program has a simple structure, which supports two distinct learning strategies: on the one hand free access to all learning materials, on the other hand a fixed route connected with the four subsequent phases of the intervention cycle. A second example of dvd-video application would be the program “Personnel Selection” (Hoogveld, VanderMeeren and Van der Vegt, 2005a), which treats the process of acquisition and selection of new staff. This includes the definition of staff requirements, its translation to observable and testable behaviours and the role of psychological tests. The design is based on expert modelling examples and a set of focused exercises. Feedback is arranged by presenting built-in expert solutions. Third, the training program “Practicum Assessment Center” (Hoogveld, VanderMeeren and Van der Vegt, 2005b) concerns the observation and assessment of job candidates. It confronts the students with four job applicants that carry out various assignments, comprising interviews with customers and groups sessions to assess communication and collaboration skills. Students learn to observe, classify and assess the candidate’s behaviours. This dvd-video program is an ingenious “remake” of a cd-rom computer practical, which in turn was a technical conversion of a Laservision interactive video in the early nineties. All dvd-video programs are highly valued by students and teachers. “Personnel Selection” and “Practicum Assessment Center” have been awarded the Euromedia Siegel 2005 in Berlin for their exceptional educational quality. This establishes the educational potential of dvd-video.

### The menu concept as building block

While the remote control is the only input device for the dvd-video player, the user interactions are determined by predefined menu options. Through these menu options the relevant assets, that is video streams, images, subtitles, text fields or sounds, can be activated. Figure 1 displays a general representation of such a menu as a flow chart.

<< FIGURE 1 ABOUT HERE >>

While the menu is triggered by some previous action or asset, it displays the list of options. Choosing an option may activate the corresponding assets, for instance a video stream combined with Spanish subtitles. After completion, the asset may trigger another asset or another menu. Often the trigger is redirected to the same menu. Choosing an option may also directly link to an another menu. Furthermore, a menu option may change overall operational settings of the dvd-video player. This defines a filter for all assets to be displayed. For instance, changing subtitling from Spanish to Japanese would display different subsets of the available assets all over the program. This general representation acts as the sole, recurring building block of extended and complex interactive scenario's for dvd-video, while actions may include the combined launch of video streams, audio channels, graphics, texts, subtitles as well as new menus. Note that a menu itself is in fact a collection of assets, while it should be able to display the different highlighting states of the menu items; moving from one menu option to the next changes the menu's appearance by showing a different graphic.

### Building educational scenarios

The simplest type of menu structure would be chapter cueing, which means the display of a playlist for selecting the right section. When menus are combined more complex structures arise. Navigation structures should preferably be based on hierarchy (Westera, 1999). Figure 2 displays the navigational hierarchy of the dvd-video program "Practicum Assessment Center" (Hoogveld et al, 2005).

<< FIGURE 2 ABOUT HERE >>

By combining menus in hierarchical and sequential program structures interesting scenarios can be created, which include sequences with fading support, multiple choice questions, performance dependent feedback or gradually increasing complexity. Although unlike the computer the dvd-video player has very limited capacity for tracking, storing and processing of user data, smart design may allow conditional program flow, which create the impression of tailor-made routing. Figure 3 shows how program flow can be used to match student performance with appropriate learning routes.

<< FIGURE 3 ABOUT HERE >>

Students that successfully pass a test question (figure 3) are lead to route 1, which may offer a specific assignment, exercise, example etc. Students who fail is given a second chance, which in case of failure leads to route 2. Possibly route 2 will provide more hints, explanations and comments to support the students. So, even when no user data are tracked and evaluated in

1  
2  
3 production rules or other decision-making mechanisms, these routing patterns allow complex  
4 educational designs.  
5  
6

### 7 **Authoring of dvd-video**

8 If the educational blueprint and the associated assets are available, the development of dvd-  
9 video is no more than defining the menu structure and linking the assets. This job is achieved  
10 with dvd-video authoring software. Low-end consumer software is cheap and goes with most  
11 dvd-writers. It is easy to use, but it rarely supports advanced features like subtitling, multi-  
12 track audio or selective use of the remote control. For the implementation of sophisticated  
13 educational patterns mid-range or even high-end authoring software will be necessary. This  
14 offers full access to the dvd-video parameters, to the dvd-video processor and the limited  
15 internal memory of the dvd-video player (LaBarge, 2001). For instance, settings in the dvd-  
16 registers can be used to enable or disable certain keys of the remote control. High-end  
17 software allows the reuse of an asset in different menus, while low-end software would need  
18 various renamed duplicates of the same asset. High-end authoring software also offers various  
19 integrity checks and a features simulation mode to pre-test the program This is quite  
20 important in the case of complex program structures and large amounts of assets. Although  
21 high-end dvd-video authoring is far from straightforward, it is in no way to be compared with  
22 developing computer software. Authoring and testing of complex dvd-videos can be achieved  
23 within days rather than weeks. Outsourcing to a specialised dvd-video studio is inexpensive  
24 and uncomplicated.  
25  
26  
27  
28

### 29 **Appropriate media selection**

30 The decision to use a particular educational medium is the start rather than the end of the  
31 instructional problem analysis. Various alternatives, like computer courseware, a web-based  
32 application, possibly combined with lectures, books or other instructional modalities have to  
33 be considered to choose the best solution. Such decision will depend on target group  
34 characteristics, learning objects, the subject matter, its role and position in the curriculum, the  
35 number of students, expected life span, cost and the overall educational context and culture  
36 (Salomon, 1981; Westera, 1995). While these situational constraints often yield the decisive  
37 motives, universal rules for the selection of media cannot be given. Yet we can zoom in on the  
38 intrinsic characteristics of dvd-video and try to identify possible strengths and weaknesses.  
39 We will make a comparison with two viable alternatives: stand-alone computer courseware  
40 (e.g. dvd-rom or cd-rom) and web applications. The overall comparison is given in table 1.  
41  
42  
43  
44

45 << TABLE 1 ABOUT HERE >>

46  
47 Below, we will briefly discuss the various characteristics.  
48

#### 49 *Flexible use of multimedia*

50 Because of its menu facilities the use of dvd-video may be sensible when the flexible and  
51 interactive use of multimedia assets is indicated. Of course, this can be realised through  
52 computer programs as well, but it is interesting to note that complex interactive programs can  
53 be realised on dvd-video without any programming effort.  
54  
55

#### 56 *Large amounts of audio and video*

57 Because of its storage capacity dvd-video can carry large amounts of multimedia data, like  
58 audio, graphics and video files. Naturally, such data might also be distributed on dvd-rom to  
59 be retrieved by computer programs. Distribution over the web is still questionable, as  
60 broadband access is still in its infancy.



### *High quality audio and video*

As indicated before dvd-video uses the high-quality mpeg2 standard to be displayed on a tv-screen. In contrast, most computers still use the unpretentious mpeg1 standard which usually is part of the operating system. Nowadays many computers contain a built-in dvd-rom player or recorder, which can emulate a dvd-video player while using the right player software. This software includes the mpeg2 codec, which is subject of a license fee.

### *Various subtitling*

Dvd-video supports the flexible use of subtitles, either for instructional purposes or for multi-language versions. This can also be arranged for courseware and web applications, be it that additional efforts are necessary to develop or select the right software and to integrate it within the program.

### *Tailored routing*

Although dvd-video allows the construction of detailed workflow layouts, the amount of user-led adaptability is restricted. Computer programs, in contrast, will be able to retrieve user data, to log user actions and preferences and to evaluate user performances and thus will be able to provide personalised learning environments.

### *Reliability*

Because dvd-video is a world standard, it displays an unprecedented reliability: no hardware conflicts, no driver problems, no corrupted files or fatal errors, no server problems, no viruses, spam, worms, spyware or trojan horses. Probably, only severe hardware damage due to flooding, over-voltage, power spikes, overheating etc will stop a dvd-video player from functioning properly. Usually, a dvd-video will always run.

### *Ease of use*

Here also the dvd-video beats the computer alternatives manifestly. The functional restrictions of the dvd-video run into an unequivocal advantage. Working with dvd-video is simply restricted to choosing menu options with the remote control. Complex interactions or the interference with other software will not occur within the confinement of the dvd-video standard. Not without a touch of irony one might claim that no typing skills are required.

### *Cost*

Two factors make dvd-video development an affordable option in comparison with computer applications. First, no programming effort is needed. Minor dvd authoring efforts warrant complex and reliable interactive programs. Second, no software maintenance, web server operation and costly users helpdesks are needed to sort out bugs, to assure proper functioning or to support users. Yet, the mpeg2 standard may give rise to higher production cost because of the need for high quality footage. But when the assets are available already dvd-video is much cheaper than a computer program. The program "Social Psychology" mentioned above has been implemented both as a cd-rom and a dvd-video. Net production cost of the cd-rom version were €17.500, including €10.000 for software development. The dvd-version took only half of this: € 8500 (Van der Vegt et al, 2005).

### *Data input, data storage and data processing*

Here we arrive at the weak spots of dvd-video. The dvd's remote control is the only input console. No keyboard, mouse or microphone is available. Data entry is obviously no more than simply selecting menu options. Hence dvd-video users are abstained from writing texts,

1  
2  
3 designing diagrams, making calculations ect. Dvd-video is a read-only medium. No user data  
4 tracking or data storage is possible. No user profiles can be built up or stored to be used for  
5 evaluating personalised routes. The intelligence of dvd-video dulls as compared with the  
6 processing capacity of a computer.  
7

### 8 9 *Network communication and workspace integration*

10 This, of course, is also a significant topic in favour of the computer. Dvd-video is a self-  
11 contained stand-alone medium in the tradition of the book or the video cassette. No network  
12 communication is possible: no data exchange with a server or other users. This has far-  
13 reaching limitations for the instructional scenarios. Within the framework of a dvd-video  
14 program there will be no access to external resources (internet), no communication with  
15 institutional administrative systems, no access to external portfolios, no communication with  
16 tutors and peers, etc. Collaborative work can only be arranged by using dvd-video in  
17 combination with additional communication facilities or face-to-face sessions. Another  
18 disadvantage is the impossibility of media integration: local data exchange (cut, copy, paste,  
19 drag and drop) with other applications, like a spreadsheet or a word processor is not possible.  
20  
21  
22  
23

### 24 **Conclusion**

25 Dvd-video is an interesting candidate for achieving interactive multimedia in education. It  
26 offers high quality sound and images, complex program structures, easy operation, high  
27 reliability and low cost. Successful dvd-video programs have been developed for the  
28 academic degree programme on psychology of the Open University of the Netherlands.  
29 The drawbacks are obvious: menu-driven only, no input of user data, no network  
30 communication. Despite the growing importance of the internet, digital television, mobile  
31 networks and other technologies that support the access to networked communities, systems  
32 and content, however, dvd-video has achieved a stable and profitable position in the consumer  
33 electronics market. This has been procured by the efforts of the motion-picture industry to  
34 define a world standard for the distribution of digitised movies. By now the VHS video  
35 cassette has been replaced successfully by the dvd-video. Its focus on digital technologies  
36 rather than mechanical technologies has produced superior quality at very low prices.  
37 Excellent dvd-video players are available already from \$30. Yet, it is hard to tell what the  
38 impact will be of upcoming broadband internet, ambient learning technologies and the  
39 increased competition between network providers that use different access and distribution  
40 channels (telephone, cable, ether, satellite, mobile). Clearly, all this may affect the position of  
41 stand-alone media. By now, the consumer electronics industry is preparing already a  
42 successor of the dvd-video. Philips, HP, Sony and Samsung are jointly working on Blu Ray,  
43 while Toshiba, Nec and Warner aim at HD-DVD (High Definition DVD). If the industry  
44 succeeds again in agreeing on a world standard, stand-alone media will be boosted once  
45 again. Then again education can ride on the waves of the entertainment industry.  
46  
47  
48  
49  
50  
51

### 52 **References**

- 53 Hoffos S, Smith P, Sharpless G & Lewis N (1992) *Cd-I Designer's Guide* McGraw-Hill,  
54 London.  
55 Hoogveld A W M., Bos A E R & Van der Vegt G W (2002) *Social Psychologie, Attitudinal*  
56 *and behavioural change (dvd-video)* Open Universiteit Nederland, Heerlen.  
57 Hoogveld A W M, VanderMeeren W M F & Van der Vegt G W (2005a) *Toolbox Personnel*  
58 *Assessment: Personnel selection (dvd-video)* Digitale Universiteit, Utrecht.  
59 Hoogveld A W M, VanderMeeren W M F & Van der Vegt G W (2005b) *Toolbox Personnel*  
60 *Assessment: Practicum Assessment Center (4 dvd-videos)* Digitale Universiteit, Utrecht.



- 1  
2  
3 Kulik J A (1994) Meta-analytic studies of findings on computer-based instruction in Baker E  
4 L and O'Neil jr H F O (eds) *Technology assessment in education and training*, Lawrence  
5 Erlbaum Associates, Hillsdale NJ, 9-33.  
6  
7 LaBarge R (2001) *DVD authoring and production An authoritative guide to DVD-Video, DVD-*  
8 *ROM and WebDVD* Lawrence, Kansas.  
9  
10 Taylor J (2000) *DVD demystified* McGraw-Hill, New York.  
11  
12 Salomon G (1981) *Interaction of media, cognition and learning* Jossey-Bass, San Francisco,  
13 Washington, London.  
14  
15 Spot (2005) *Televisierapport 2005* Stichting tot Promotie en Optimalisatie van  
16 Televisiereclame, Amstelveen. Retrieved online februari 18 at  
17 [http://62.250.9.21/spotDownloads/SPOT\\_Televisierapport\\_2005.pdf](http://62.250.9.21/spotDownloads/SPOT_Televisierapport_2005.pdf)  
18  
19 Van der Vegt G W, Westera W, Hoogveld A H W & Puls J. (2005) De dvd-video als  
20 educatieve verrassing *OnderwijsInnovatie*, 4, 17-25.  
21  
22 Westera, W. (1995) *Audiovisueel ontwerpen, theorie en praktijk, conceptontwikkeling voor*  
23 *film, video en televisie*. Abcoude: Uniepers.  
24  
25 Westera W (1999) Verstrikt in het web: over webgebaseerd onderwijs *OnderwijsInnovatie*, 2,  
26 17-24.  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

Figure 1

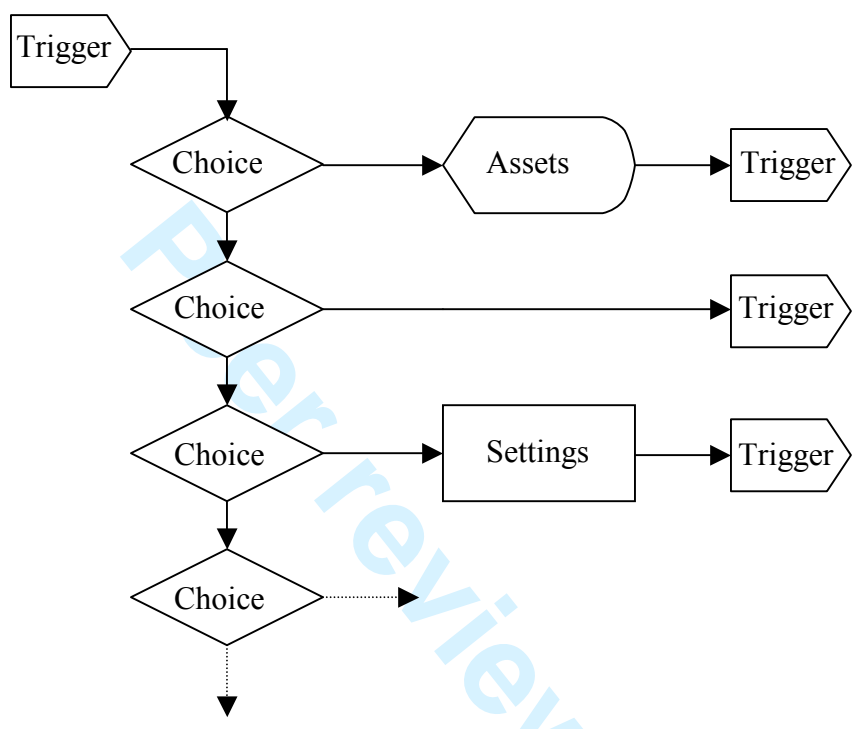


Figure 1: General menu represented by a flow chart

Figure 2

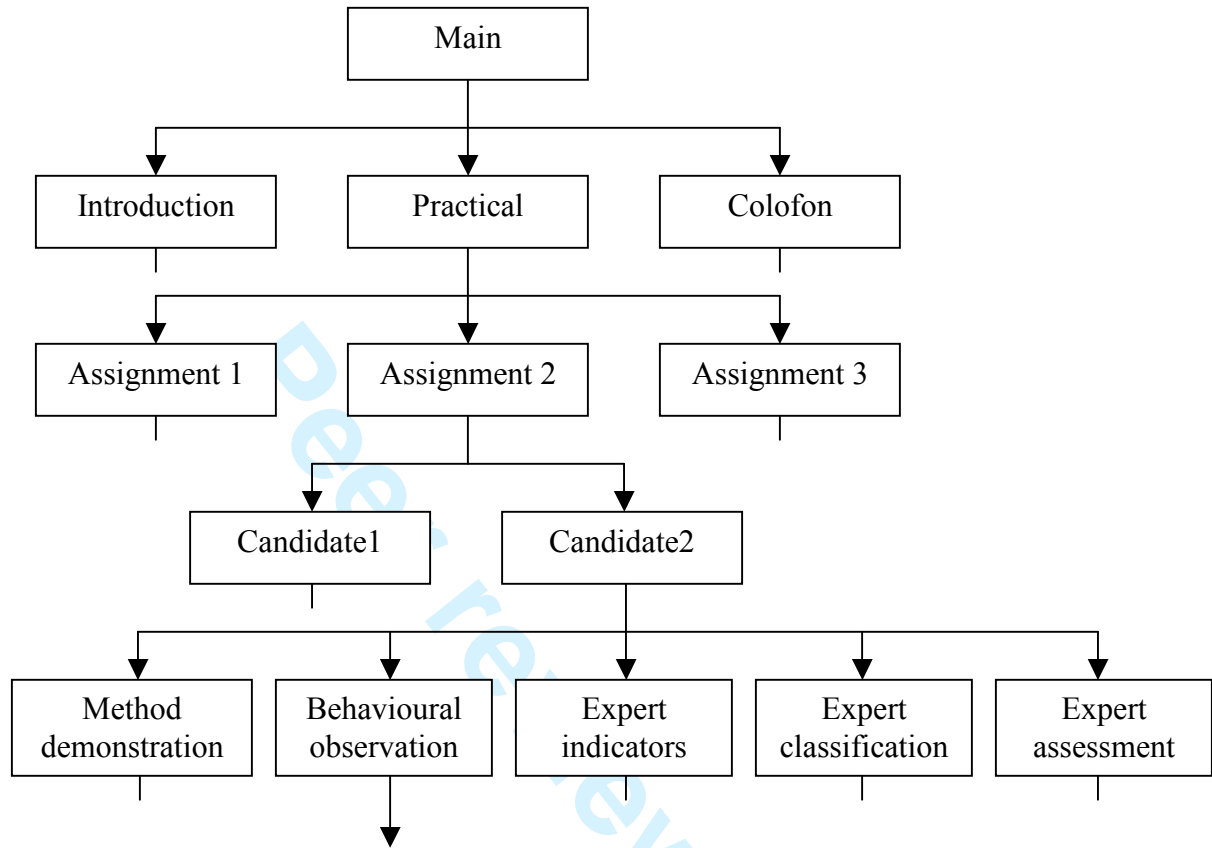


Figure 2: Part of navigational hierarchy of “Practicum Assessment Center”

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

Figure 3

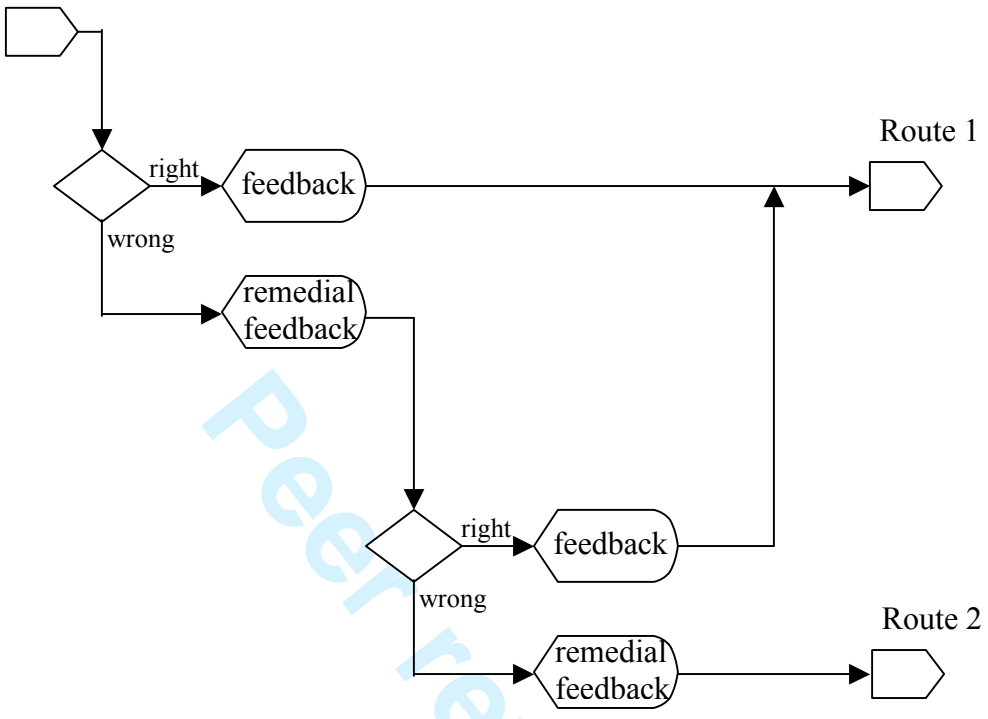


Figure 3: Example of performance-dependent routing

Table 1

	Dvd-video	Computer courseware	Web application
Flexible use of multimedia	+	+	+
Large amounts of audio and video	+	+	-
High quality audio and video	+	+/-	-
Various subtitling	+	+/-	+/-
Tailored routing	+	+	+
Reliability	+	-	-
Ease of use	+	-	-
Cost	+	-	-
Data input, data storage and data processing	-	+	+
Network communication and workspace integration	-	+	+

Table 1: Comparison of dvd-video, computer courseware and web applications