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Educational Video and TV in Distance Education - Production and Design Aspects -

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Abstract: Starting from some basic characteristics of instructional video and TV steps in production and organization will be described in detail. Then the scope is extended to discuss more general design concepts in instructional filming. As video sequences frequently form part of multimedia instructional software the respective production and design concepts gain importance in software development as well.
Keywords: distance education, instructional film, educational television, educational design
Category: A.m

1 Introductory Remarks

Video and TV today form a valuable part of many distance teaching programmes around the world. In some systems they are even the core element in delivering the teaching load. In others they are only a supplement to the voluminous printed course material. However we can often observe that professional production and design of these materials is still something that costs academics a lot to get acquainted to. In this article we will refer to instructional video and TV in a sense that differs from simply recording tele-classes. In instructional video and TV we try to consciously apply the characteristics of filming. The objective is to bring educational events to the student that he would not be able to access otherwise. Lecturing may form part of these instructional films but usually is not the key element. In what follows we will give some very basic hints about production and design aspects that may help to improve audiovisual educational programmes. Some of the aspects mentioned below may be rather technical and well known to a professional media expert. Others may be obvious to an educationalist or didactic expert but unfamiliar to an audiovisual engineer. As both have to communicate adequately with each other they have to share some common knowledge. To facilitate this communication is the purpose of this article.

2 Video and TV - Differences and Common Characteristics

Of course both media are audiovisuals combining sound and images in a dynamic interrelated way. However there are some important differences which should always be remembered when talking about production and design of audiovisuals. First TV is limited to fixed time slots so that transmission hours and duration are fixed whereas in video production duration is flexible and viewing time is up to the student. Videos can be stopped any moment and be repeated whenever the student wishes to do so. These characteristics allow to relate videos much closer to other study materials such as print. TV standards exceed high quality production whereas technical quality of video can be determined by the educational institution although today differences are fading due to improved standards of semiprofessional equipment. According to its open dissemination TV reaches also population segments outside the proper target group which leads to continuous discussion about the adequate topics and the academic level of the educational transmissions. Finally reception of video is limited to equipment of videorecorders whereas TV sets today are accessible to most private homes. In the description of production and design we will talk about audiovisuals in general and point to differences only when needed.

3 Scientific Films for University Courses „From the Idea to the Finished Video“

The specific structure of the FernUniversität (German equivalent of the Open University) as a media-based university makes it necessary to produce and use audiovisual media - in particular video films.

The video films used in correspondence degree courses can be classified in the genre of scientific films. According to [see Silbermann 1982] there are four distinctive features which characterize a scientific film:

- the subject matter originates from a scientific discipline,
- the target group is students at institutes of higher education,
- the level is tailored to the target group,
- production is the responsibility of suitably qualified producers.

As a rule, scientific films used at the FernUniversität are linked to a study unit of the correspondence degree course. However, it is also conceivable to have productions which assist the student in mastering specific situations in the correspondence course (e.g. examination situations) or which address current themes in the particular discipline. Furthermore, owing to the specific situation in the correspondence degree course, it may be useful to document seminars or lectures in order to make them accessible to a large number of students.

FernUniversität video productions have distinct characteristics of the didactic film on account of the context in which they are used. Didactic films can be regarded as fulfilling five functions:

- *representative function* for phenomena which cannot be experienced at first hand,
- *preparatory function* for complex interrelationships pertaining in reality,
- *complementary function* for experiencing reality,
- *objectivizing function,*
- *information function* [see Silbermann 1982].

In addition to the above, a further characteristic of FernUniversität scientific films is their use in the television programme „FernUniversität im Dritten - Wissenschaft direkt" broadcast by Westdeutscher Rundfunk (WDR).

A video production begins with a planning discussion in which the cooperating partners - who are usually the representatives of the university faculty and the ZFE editor - draw up a rough concept. This preliminary discussion is followed by further rounds of talks during the course of the project. The conception of the film is based on the objectives for the production which are set by the university faculty.

The most important questions dealt with in the planning discussions are:
What aspects of the subject matter are indispensable for translating it into a film?
Which forms of representation, apart from the real image, are necessary, e.g. graphics, illustrations, texts, photographs, archive records?
What material cannot be presented in the form of a film?
Which cooperating partners are to be involved, and in which functions (e.g. as interview partners)?
What locations are to be used for filming?

The role of the university faculty staff principally concerns the question:
„WHAT message is the film required to convey?"
ZFE representatives are responsible for the question:
„HOW is the subject matter to be translated into a film, in the didactic sense (Editor) *and in the cinematographic sense* (Producer)?"
The result of the first discussion phase, which may comprise one or several sessions depending on the subject and structure, is the *rough draft* or *outline.*

„The rough draft - often called the „outline" - sets down the subject in writing for the first time. In a few lines the author draws up an orientation framework, formulates his wishes and message, outlines the content and evaluates the relative importance of the different aspects."
[see Schult and Buchholz 1990].

This general definition of the rough draft has to be adapted to the specific circumstances of FernUniversität productions.The outline therefore also includes information about the persons involved, the relevance to the course of study, the learning objectives and the didactic structure (first contact, elaborating, reinforcing etc.) [see Laaser 1994].

Since the cooperating university teachers, who are generally authors or co-authors of the productions, are burdened with other teaching duties, it is principally the job of the editor to summarize the objectives, points of emphasis and conceptional considerations that have become apparent in the discussions.

A television/video production is only possible by working as a team. The complex technical and organisational structures of such a project make it necessary for numerous experts to be involved [see Fig. 1]. For this reason a project team is formed.

The participants are:

- Representatives of the university faculties as authors or external authors commissioned by the faculties
- Editor from the ZFE (also acting as co-author in individual cases)
- Producer from the ZFE
- Camera team
- Sound mixer
- Vision mixer
- Video engineer
- Video-graphic designer
- Speaker for the commentary texts

In addition to these persons, each of whom makes a very specific and indispensable contribution to the film, there are also all the people who act as discussion participants or perform other roles in front of the camera.
If a large number of people who are also involved in other projects take part in the film, early planning of schedules is an essential prerequisite for the success of a video production.

If the university faculty and editor are in agreement regarding a joint objective and the fundamental conception, the producer must be consulted at this point at the latest. Questions concerning the actual picture composition and visualization of a particular subject matter must be elaborated in collaboration with the producer.
After the outline has been submitted, the rough production schedule must be fixed in consultation with all the participants.

Central questions affecting the latter are:
When does the university faculty wish to use the video?

When are studio facilities for shooting and editing available?
When can graphics be produced?
When can sound recordings take place?
What broadcasting deadlines have to be met?
When will filming locations and cooperating partners (interview partners) be available?

All questions concerned with scheduling can only be answered in the context of the overall volume of production work at the ZFE. Timeframes can be in terms of weeks or even months.

Once the rough structure of the film has been decided, the next step is to research possible *filming* locations, find *interview partners,* obtain and sort through *archive material,* and lots more besides.
This research work takes a considerable time and is one of the decisive factors affecting the final shape of the film.

A few examples to illustrate the above:
There is little point in arranging a discussion with a key person if it is not certain that this person will be available during the period in question. It may be necessary to make a change to the film conception. It makes no sense to plan to film specific production machinery in a company if it is not possible to get the necessary permission for filming.

Furthermore, the research work described provides the opportunity to deal with the film's subject matter in greater depth, which may in turn be useful when implementing the idea into the *treatment* [see Fig. 3].
„The treatment develops the rough draft a stage further. As the preliminary stage of the film plan, the shooting schedule and/or the film script, the treatment describes the subject matter in greater detail and states the message more precisely: What does the film aim to achieve?(...) Initially approximate and non-binding statements are now put into definite terms: How long will the film be? Where will it be filmed? Who will make a statement? What interview partners are planned?" [see Schult and Buchholz 1990].

As a rule, the treatment is prepared by the editor with the participation of the university faculty representative.

Once the possible filming locations are fixed and interview partners have been found, it is advisable to pay an advance visit to the locations with the producer.
This extra expenditure, which is always justifiable except if a very long journey is involved, serves to analyze the locations from the technical/cinematographic point of view (camera positions, light conditions and acoustics). The preliminary visit makes it possible to take into account any peculiarities of the location and prepare the necessary equipment accordingly.

Furthermore, the plans drawn up on paper in the treatment can be adapted to conditions on location.

An example of the latter:
Planned interviews with employees at their places of work make little sense if the noise level is so high that sound recordings are impossible. An advance visit to the location avoids surprises which lead to delays during shooting.

The film script is a synthesis of what the film location permits, what is scientifically necessary and what is cinematographically desirable. It has to take into account the wishes of the university faculty, the editor and the producer.
The film script, as the basis for communication, facilitates organisation of filming deadlines, work on location, provision of the information required by the video-graphic designer in order to translate the subject matter into graphic form. But, at the same time, it serves to give the representatives of the university faculty an impression of how the resulting film will actually look.

In order to design graphic sequences of a film and to provide the graphic designer with a basis for his work, it is necessary to prepare a *storyboard* [see Fig. 1].

„The storyboard anticipates the planned film in full or in part. With a more or less comprehensive collection of sketches the author is able to represent the scope of his contribution, or equally to single out individual picture blocks or sequences which he considers particularly important or difficult."
[see Schult and Buchholz 1990].

Out of the film script arises the *shooting schedule,* which contains the time sequence and content structure of shooting on location. It also provides all participants in the project with information about the processes taking place on location at any point in time.

The production phase, in which the shooting takes place on location or in the studio, is organised by the editor with the participation of the producer. In individual cases the involvement of the university faculty staff may be desirable also at this stage. In addition to the aforementioned persons, the group on location also comprises the camera man and assistant, so that, as a rule, four or five people are present during shooting. Work on location is recorded in the shooting log. Interviews are conducted by the university faculty representatives themselves or by the editor, and it is not unusual for the faculty staff members to also make statements in front of the camera.
After shooting is completed, which may take days or even weeks, there are numerous follow-up jobs to be done before editing of the material can be contem-plated.

Since the professional video format, BETACAM SP, is used for shooting, the film first has to be re-recorded in the VHS format for the purpose of sorting the material.
During this copying process the *time code* is recorded in a visible form on the VHS tape. The time code is recorded on a separate track of the video tape and assigns unique time information to each individual picture. Thus, it enables a video picture to be precisely located on the original tape. On the basis of these VHS tapes a *sorting list* is made, in which the picture content of individual takes, their length and precise position is recorded by means of the time code. Similarly, after shooting, and with the aid of the shooting log and sorting list, the film's voice-over or *OFF-screen texts* are prepared.
Off-screen texts are the texts which are spoken by trained speakers for the individual picture blocks. The name off-screen texts reflects the fact that the person speaking - in contrast to an on-screen narrator - does not appear in the picture. The *editing plan* is derived from the sorting list and the off-screen texts.

The editing plan and film script determine the length and sequence of the picture blocks. They assign the definitive off-screen texts to the picture blocks. In addition, they contain technical instructions and information concerning insertion of captions and graphics. The editing plan and the information it provides, especially the time information, must correspond to the finished film to the greatest possible extent.

Preparing the editing plan is the job of the editor and producer, taking into account the requirements specified in the film script. The editing plan with the off-screen texts and the selected picture blocks anticipates on paper the way in which the film will subsequently be produced on the editing table.
Since it is the last written version before final production of the film, it must be authorised by the university faculty.
For this purpose the off-screen texts must be submitted by the author in their final form. No changes to picture or text are possible after editing.

Before picture editing takes place the *voice recordings* are usually made in the recording studio. Here exact timing of the texts is critical. Both the length and content of the texts must match the picture blocks perfectly in order to ensure *picture-text congruity.* The coordination of picture and text is of central importance for the comprehensibility and remembrance level of the film's content. Therefore, the pictures are edited to fit the text.
In exceptional cases where the text is made subordinate to the pictures, the reverse procedure may be used, but that is conditional upon the length of the picture blocks being fixed precisely, since the text is not available as a „timer“. Such a method of working may be useful with self-explanatory pictures or test representations and the like.

Apart from the producer, editor and, if necessary, the author (university faculty representative), it is above all the vision mixer or video engineer and video-graphic designer who are involved in the editing process.

The film is edited at the ZFE studio on the basis of the original material in BETACAM SP format.

Picture editing with addition of the off-screen texts is followed by sound processing. The latter is the job of the recording engineer and comprises mixing of the general *ambient noises* (wild track effects), *off-screen sounds, on-screen sounds* and *music,* the latter mostly being composed specially for the particular production.

After the sound mixing the resulting original tape (master tape) is reused in two respects.

One copy - namely the copy of the video production in the form in which it will later be used for teaching purposes - is sent to the copying plant, where copies are made for a fee according to requirement. Once editing has been completed more time elapses before a video production is available as a VHS cassette.

The second processing takes place for broadcasting the production as part of the programme, *„FernUniversität im Dritten - Wissenschaft direkt"* [see Fig. 2]. For this purpose the video production is integrated without any modification into the overall concept of the FernUniversität broadcast.
Presenter's texts are written, which are spoken by professional presenters at the FernUniversität studio. These texts provide an introduction to the subject matter of the film and the circumstances in which it came to be made. Following the scientific film, which usually lasts a maximum of 27 minutes out of the 30-minute broadcast, information is given about other FernUniversität video productions and about where the video cassettes can be purchased. Finally, „Pictures from Hagen" (architectural history) or „Pictures from the FernUniversität" (institutes of the university) are shown. The date for broadcasting a production in the „FernUniversität im Dritten" series is set far in advance, thus providing a framework for scheduling a production. A certain amount of time elapses between the video production and actual broadcast of the programme. It may be that a video version is available before the broadcast or only afterwards. That depends principally on the dates of production and broadcast.

4 Some General Concepts Relevant for Design of Instructional Films

What makes instructional video and TV different from other TV contributions such as magazines? In instructional TV we want students to learn. Therefore it seems reasonable to look at some basic insights that we can gain from the theory of perception. One of the paradigmata is that learning happens only after perception. So we have to give time to the learner to really perceive the message. If the subject matter is difficult we have to slow down the speed of presentation. Educational TV is not a commercial spot. Summaries, advance organizers or other structuring devices are certainly here as valuable as they are in print or other educational media.

Perception is also more relative than absolute. That means that we have to vary the stimulus to attract the viewers interest. This does not contradict with the prior statement. If we cope for a well planned change of presentation techniques such as graphical illustrations, group discussions, real life illustrations etc. and if we use these different formats in a didactically structured way we usually can provide enough stimulus for the interested learner.

Furthermore advantage can be taken from the selectivity of human perception. Video and TV techniques today offer a wide variety of effects to direct student´s interest to certain segments on the screen. Complex diagrams can be developed stepwise, details can be dropped and added according to their momentary relevance. Selectivity of perception is also relevant for the combined effects of sound and images. If audio information is dense and complex then the image should not distract too much and vice versa. As academics are used to lecture they often have difficulties to let the image "live" without a spoken comment. On the other hand some "media experts" consider a joint combination of background music, spoken comment and moving real images all at the same time as extremely catchy without really caring about what students may learn from such a sequence.

Another important theoretical strain is the "Gestalt"-psychology which claims that good forms should correspond to the laws of proximity, equality, closeness, experience and exactitude. We can profit of these findings especially in the design of graphical representations, e.g. horizontal and vertical lines are more easily perceived than other lines, or short visual symbols which represent a condensed form of natural or real life images may be easier to perceive than mathematical symbols.

5 Design of Single Elements

5.1 The Presenter

Normally at least part of instructional videos or TV transmissions is presented by faculty members. The advantage is that students usually studying in isolation can see their teacher on the screen. Another advantage is that the academic staff is more familiar with the subject matter and that there is normally no extra cost involved. However as we have to deal within the university environment with more or less TV-unexperienced faculty members even an uninterrupted take of five minutes may pose a problem for the presenter. Therefore it is recommendable to plan very short takes interrupted by other elements such as graphical representations, real life illustrations or animation parts. Takes for the speakers should be as short as one or two minutes. Furthermore presenters should be asked not to read their text or to learn it by heart beforehand. They should just note some key words if necessary. If they present a programme for the first time it may be useful to introduce them to the studio already some day before actual recording. On this opportunity already simple issues such as dress or lecturing habits can be discussed to prepare an appropriate studio setting later on. Unprofessional presenters also need some time to warm up so it can make sense to record the first takes once more at the end of a studio session. To contrast the voice of the presenter we often use a contrasting voice for the off-comments e.g. if the presenter is male we use female voice for the off-commentary.

5.2 The Interview

Interviews are frequently used to incorporate external expert knowledge. However to make a good interview some simple rules should be respected. First, the interviewee should play the important part not the interviewer. Second, the interviewer should take the perspective of the spectator or student who is watching the programme. Third the interviewer has to react on the answers given by the interviewee. Therefore it is not recommendable to prepare all questions in detail beforehand and to limit the interview to one or two central aspects only. The first and the closing questions should be well planned to give the interview a clear message. To speed up an interview the interviewer can use prior information that he gained from preliminary talks with the interviewee. As a trainer once remarked, the art of an interesting interview consists in bringing the interviewee to talk about aspects that he normally would not reveal in a simple statement.

5.3 Group Discussions

With respect to filming group discussions pose a greater challenge than interviews or statements. Here the role of the facilitator is of crucial importance as he has not only to direct the discussion but has also to support by his gestures direction of cameras. Therefore he should be placed always in the middle of the group. The opposing parties should be placed on opposite sides of a half-circle arrangement. Maximum size for group discussions should be less than ten preferably five to six. For proper filming at least three camaras are necessary. Zoom or panning should be used only exceptionally, instead shots and reaction shots can be used. In general life recordings are preferable. Camera operators can be directed via headphones (Intercom).

5.4 Graphical Representations

Graphics are a common element of most instructional films. They include cartoons, diagrams and illustrations. Some basics may be mentioned when graphics are to be prepared. First, the screen format (3 to 4) has to be respected and a security margen has to be left because of different monitor sizes. Second, characters have to be readable, which seems obvious but is often disregarded. A broad rule is that minimum size should be no less than 3 cm given a visible monitor diagonal of 64 cm. Lines should have a minimum thickness of 0.5 cm and should not include more than 30 letters. Third with respect to colours pastel tones and non reflecting materials are recommendable. Finally as mostly various graphical sequences form part of a single film, design for all sequences should maintain some common characteristics, e.g. background colours, characters, symbols, design style. This is in line with the laws of equality and experience from "Gestalt"-psychology mentioned above. It helps students to decode rapidly the graphical message as by the time certain elements become familiar to them.

6 The Language of Filming

As we do not intend to lecture about filming we just give some practical hints that also an instructional designer may keep in mind when producing some audiovisual material. We have a variety of elements and techniques that have to be used and combined effectively e.g. composition of the image, shooting angles and position (long shot., medium shot, close-up), camera perspective and movement, cuts and fades, sound, light and editing. There are no fixed rules how to use each element but for the "non artist" and "non professional" educational designer it may be useful to respect some guiding principles.

First let us deal with the composition of the image. Normally if a face is to be shown on the screen we should leave some space at the margins. If the speaker looks to the left we will place him to the right side and vice versa. Persons should look directly at the camera and the camera should be at eye level. Groups have to be arranged with different distance to the camera to generate some space effect.

Second, to relate different takes we usually have to cut. As shooting formats and angles have their proper meaning and impact it is already important while shooting to think about the next take that follows. Cutting within the same frame or angle is mostly inadequate. Cuts can be made less obvious if e.g. a movement continues in the next frame, if some basic visual structure prevails or if some sort of symbolic analogy can be used to hide the cut. Of course there are also other means to relate different takes such as fades, superimposition or blurring but these are usually less frequent.

One of the typical settings in a semi-professional environment is the filming with just one camera. Here we should choose primarily relative "quiet" images, fixed frames and camera angles instead of zoom or camera movement. Also filming from a tripod is most recommended. Bright objects should be placed against dark backgrounds and vice versa. Also reverse lighting has to be evited.

In editing we basically have two types of post-production. The first one is simply to paste one element to the next according to their final order. This way of editing is called assemble edition and is used if the film script is not very detailed and if the main work is left to the editing. In instructional films where the sound track often is the leading element post-production by insertation is often more relevant. Sound tracks for off-commentaries are prerecorded and lacking graphical illustrations or real life images are inserted later on to those parts of the master tape left in black before. This allows to determine the exact duration of the production before completing all editing and gives more flexibility to organize post-production. However in reality both types of post-production are used jointly.

With these brief remarks we will end our discussion of the more technical aspects and stress that there is certainly no rule in filming that has not been broken. In the next paragraph we will summarize the various aspects of instructional films dealt with before and list some of the most relevant criteria to rate and compare quality of instructional audiovisuals.

7 Guiding Principles to Analyse Instructional Films

First we should check wether the content is relevant for the target group and wether style and density of information are corresponding. The subject matter has to be presented in a logical sequencing. Relation to other existing course material has to be considered.

With respect to the didactic structure we should look if an initial motivation is given, if the problem is well presented and if learning is supported by structuring devices.

Visualization should cater for changing presentation formats, good composition of single images as well as for expressive images that really support the audio. The montage should be technically correct and adequate. Audio information should be recorded clearly and language style has to be adapted for listening.

Finally we should check whether time for investigations and script writing has been not excessive, whether organization of external shots and shooting ratios are justifiable, whether utilization of studio capacity has been as planned and whether graphics have been well prepared in time.

We can see that analysis of an instructional production is a rather complex issue. But it is indispensable, although sometimes harmful for team members, when we want to improve our products.

8 Future Perspectives of Instructional Video and TV in a Changing Environment

Audiovisuals have been frequently under attack. Some were critizising the high production costs others were questioning accessibility of audiovisuals for students at home. Also the efficiency of audiovisuals to deliver effectively teaching content has not always been accepted.

More recently challenges came from technological revolutions in telecommunications. Teleclasses popular in the US claim to be a low cost approach to deliver expert knowledge without use of special design patterns known from instructional TV. The other attack comes from integrated multimedia software for personal computers incorporating animation, sound and video on a single compact disk.

Having all this critique in mind it may be useful to remember some of the essential media attributes that made audiovisuals survive in a sometimes unfavourable environment. When we started videoproduction at the German FernUniversität around 1978 only about 8 p.c. of private housholds possessed a videorecorder at home. Today this percentage in Germany is around 70 p.c., in Great Britain around 90 p.c. and in Holland about the same as in Germany. Distribution of video and TV via cable and satellites extended enormously the coverage of spectators. In the future also „video on demand“ may offer additional prospects in distribution. Costs of production can be reduced by sharing some of the development and investment costs with either public TV companies or in case of video with private editors that are interested to market attractive productions outside the distance education system.

With respect to integrated multi-media software we know that accessibility at the moment even in countries such as Germany or Britain is still very low. To play multimedia software at home relatively high powered personal computers equipped with sound cards and CD-ROM drive are indispensable. Also development costs are comparatively high as not only sound, video and text have to be combined but individualized access and interaction has to be provided as well. Finally software development to make it a powerful tool usually is conceptualized in relatively large bits. However within the university environment only short term dedications of faculty staff to develop such programmes can be achieved. These are clearly some restrictions for a large scale development of integrated multi-media software. On the other hand the storage of print, audio or audiovisual materials on a single medium such as a CD will offer another promising distribution channel for video productions.

Switching now to teleconferencing we found the technology may be adequate to extend some on-campus lectures to remote sites, especially local centres, but fixed time schedules, high costs for lecturing hours, expensive investment in necessary infrastructure as well as high line costs impeded the rapid introduction of such systems to large scale distance teaching institutions so far. However, more recently ISDN-based low cost conferencing systems may change this perspective in part. In any case teleconferences are a unique event and are restricted to a selected group of participants that have excess to the equipment needed for reception. So teleconferences provide an additional service to support distance learning but will not be able replace core teaching materials such as carefully designed instructional video tapes.

To conclude this point we think that there is still a case to develop good educational video and TV material. Furthermore organizational structures, strategic options and design patterns that guide the production of audiovisuals can serve as an excellent experience to incorporate later on audiovisuals and sound into integrated multimedia software. However as part of multimedia software audiovisuals probably will be reduced to small bits of source material and dynamic linkages will be replaced by individualized access facilities.

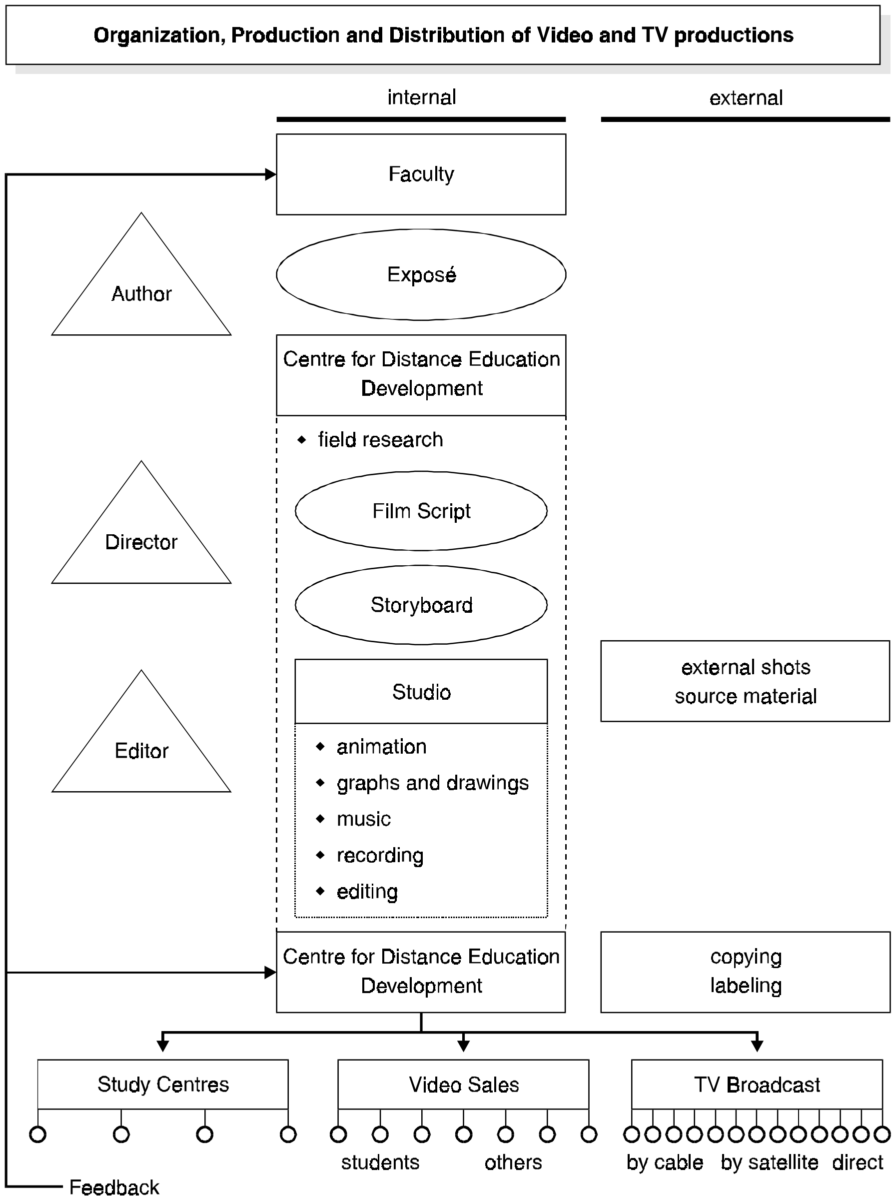

Figure 1: Organizational Chart of Video and TV-Production

		Time
(1)	Trailer „FernUniversität“	15 sec.
(2)	Presenter (Introduction to main topic)	30 sec.
(3)	Instructional film	27 min.
(4)	Presenter (links to next topic)	15 sec.
(5)	Report on actual research and academic events	60 sec.
(6)	Promotion of videos	30 sec.
(7)	Presenter (concluding remarks)	15 sec.
(8)	Trailer (Production team)	15 sec.
		30 min.

Figure 2: Structure of TV-Transmissions at FernUniversität Hagen

		time (minutes)
(1)	Title (shots at car factory)	0.15
(2)	Short statements about the concept of just-in time (managers of Ferrostahl, Krupp and Opel)	2
(3)	short summary given by Prof. Fandel just in time in production just in time in delivery	2
(4)	graphical illustration of KANBAN-loops	2
(5)	shots at car factory to illustrate production loops	2
(6)	comment by manager about merits and problems	2
(7)	must in time in delivery two different suppliers (Statement and real life illustrations)	6
(8)	provider of decentralized stock (Interview)	4
(9)	Comment by Prof. Fandel about economic benefits of just in time delivery	3
Total duration		23 ==

Figure 3: Treatment "Just in time logistics"

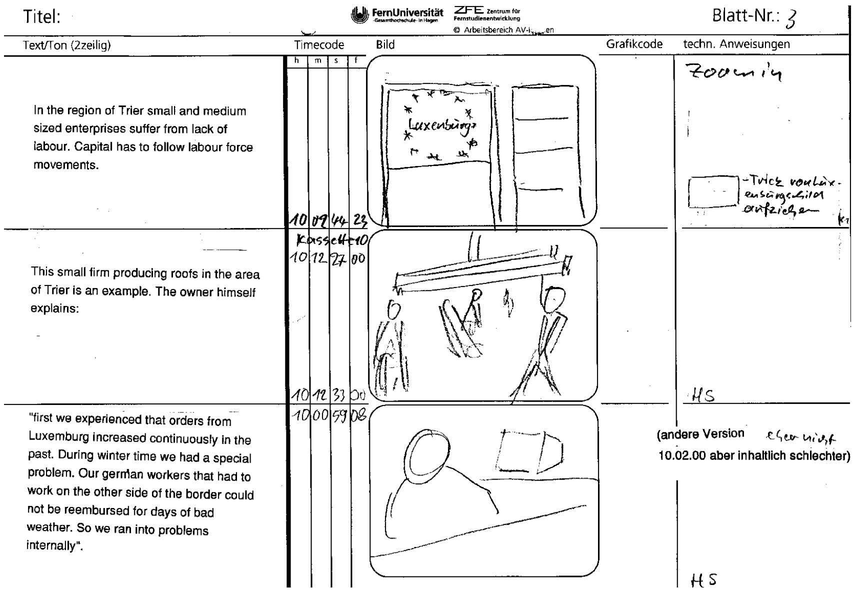

Figure 4: Storyboard „European Personnel Management“

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